No. 2014-1776

In the
United States Court Of Appeals
For the Federal Circuit

MAGNETAR TECHNOLOGIES CORP. and G&T CONVEYOR CO.,

Plaintiffs-Appellants,

v.

SIX FLAGS THEME PARKS INC.; TIERCO MARYLAND INC.; BUSCH ENTERTAINMENT CORP.; CEDAR FAIR LP; PARAMOUNT PARKS INC.; GREAT AMERICA LLC; KKI, LLC; MAGIC MOUNTAIN, LLC; PARK MANAGEMENT CORP.; RIVERSIDE PARK ENTERPRISES, INC.; SIX FLAGS OVER GEORGIA II, L.P.; SIX FLAGS ST. LOUIS, LLC; TEXAS FLAGS, LTD; ASTROWORLD, L.P.; DARIEN LAKE THEME PARK AND CAMPING RESORT, INC.; ELITCH GARDENS, L.P.; KNOTT'S BERRY FARM; KINGS ISLAND COMPANY; and CEDAR FAIR,

Defendants-Appellees.

Appeal From the United States District Court
For the District of Delaware, Case No. 1:07-cv-00127
The Honorable **Leonard P. Stark**, Judge Presiding

NON-CONFIDENTIAL BRIEF OF PLAINTIFFS-APPELLANTS MAGNETAR TECHNOLOGIES CORP. AND G&T CONVEYOR CO.

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Dated: October 28, 2014

CERTIFICATE OF INTEREST

Counsel for Plaintiffs-Appellants, Magnetar Technologies Corp. and G&T Conveyor Co., certifies the following:

1. The full name of every party or amicus represented by me is:

   Magnetar Technologies Corp. and G&T Conveyor Co.

2. The names of the real parties in interest (if the party named in the caption is not the real party in interest) represented by me are:

   Magnetar Technologies Corp. and G&T Conveyor Co.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

   None.

4. The names of all law firms and the partners or associates who appeared for the party or amicus now represented by me in the trial court or agency or who are expected to appear in this Court are:

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I. STATEMENT OF RELATED CASES

There are no related cases.

II. STATEMENT OF JURISDICTION

This is an appeal from summary judgments of invalidity and non-infringement, and from an order excluding an expert. (A000001-A000012). The basis for the district court's subject matter jurisdiction is 28 U.S.C. §§ 1331 and 1338(a); the complaint was for patent infringement. (A000107-A000114). The basis for this Court's appellate jurisdiction is 28 U.S.C. §§ 1291 and 1295(a)(1).

A final judgment was entered on July 29, 2014. (A000001-A000012). A notice of appeal was filed on August 27, 2014. (A011436-A011437).

III. STATEMENT OF THE ISSUES

1. Whether there were disputed issues of material facts regarding validity and infringement of the '125 patent.

2. Whether there were disputed issues of material facts regarding infringement of the '237 patent.

3. Whether the district court abused its discretion in excluding an expert report.

IV. STATEMENT OF THE CASE SETTING OUT THE FACTS RELEVANT TO THE ISSUES

Plaintiffs Magnetar and G&T sued for infringement of U.S. Patent No. 5,277,125 and U.S. Patent No. 6,659,237. (A000107-A000114 and A000170-

A000179, Original and Amended Complaints; A000086-A000097, ‘125 patent, and A000098-A000106, ‘237 patent). G&T acquired the ‘125 patent with the assets of BAE, a company in the airport baggage handling business. (A000086-A000097). Edward Pribonic, who owns Magnetar, invented the ‘237 patent. (A000098-A000106). The complaint accused the defendants’ roller coasters having magnetic brakes that infringed the patents.

Claim 3 of the ‘125 patent was asserted. (That claim does not include any motors for propulsion. Claims 1 and 2 do, but are not asserted. The figures of the patent therefore include motors that are not recited in claim 3). Fig. 1 of the ‘125 patent shows a slider (also called a fin, shown below in green, item 12) on the bottom of a car 1, and between two rails 8 (purple, and between two motors 16, dark yellow):

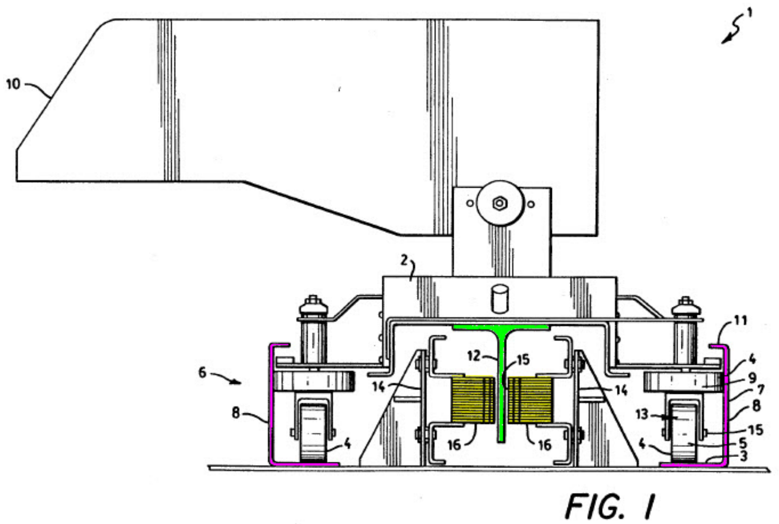

FIG. 1

(A000087 and A000091, ‘125 patent, fig. 1 and col. 3, line 52 to col. 4, line 11).

Fig. 2A shows magnet assemblies 20 mounted between the rails. Magnets (yellow, item 22) are on each side of the gap for the slider 12 shown in fig. 1 above:

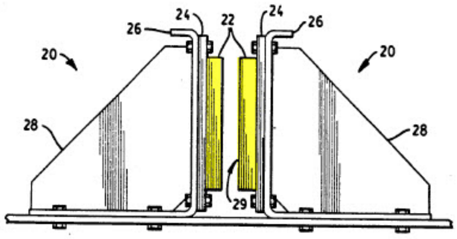

FIG. 2A

(A000088 and A000092, '125 patent, fig. 2A, and col. 5, lines 18-21). The magnets are attached to plates 26 on the brackets. *Id.*

The specification and drawings therefore depict a slider that is between the rails of the track, moving through a gap formed by the magnet assemblies between the rails. "Brackets 14 are disposed inwardly of the rails 8…." (A000091, '125 patent, col. 4, lines 13-14).

Movement of the fin or slider through the gap induces an eddy current, generating a force opposing motion of the fin, thus decelerating the fin and car. (A000090-A000092, '125 patent, col. 2, lines 36-42, col. 3, lines 2-6, and col. 5, lines 12-31).

Claim 3 of the ‘125 patent says:

> 3. Material handling car and track assembly, said assembly comprising:
>
> a car having wheels mounted thereon, and
>
> a track having two parallel rails, said wheels being adapted to roll on said rails to facilitate movement of said car along said track,
>
> a metal fin extending from an underside of said car and lengthwise of said car, and
>
> opposed magnet assemblies mounted between said tracks,
>
> said opposed assemblies being spaced from each other by a distance exceeding the thickness of said fin to define a gap between said magnet assemblies,
>
> said fin being adapted to pass through said gap in travel of said car over said magnets,
>
> each of said assemblies comprising a mounting bracket, a plate attached to said mounting bracket, and a series of magnets bonded to said plate,
>
> said magnets on said plate being disposed side by side in a direction of travel of said car on said rails,
>
> said magnets being operative sequentially to act on said fin to impart braking to said car.

(A000093 and A000095-A000097, ‘125 patent, col. 7, line 3 to col. 8, line 12 and Certificates of Correction).

The ‘237 patent also claims a magnetic brake that can decelerate a car according to the same principles. However, the magnets in the ‘237 patent are mounted to two walls, one of which can be moved with respect to the other to adjust the braking force. When the positions of poles of opposing magnets are moved, the braking force is substantially gone. (A000098, '237 patent, Abstract). Claims 1 and 10 were asserted. Claim 1 reads:

> 1. An eddy current brake comprising:
>
> a diamagnetic or non-magnetic member;
>
> a first support wall;
>
> a separate second support wall disposed in a spaced apart relationship with said first support wall for enabling the member to pass therebetween;
>
> a first linear array of permanent magnets disposed on the first wall on a side of the first wall facing the second wall;
>
> a second linear array of permanent magnets disposed on the second wall on a side of the second wall facing the first wall, the first and second arrays being parallel with one another; and
>
> apparatus for adjusting eddy current induced in the member, and braking force, as a function of velocity of the member between the arrays, said apparatus including linkages for enabling movement of the member therepast to change the spaced apart relationship between the first and second walls.

(A000105-A000106, '237 patent, col. 6, line 56 to col. 7, line 8). Claim 10 is very similar; it recites magnet arrays, but not walls. (A000106, '237 patent, col. 8, lines 28-42).

The district court construed the claims of the patents. (A000800-A000817). It decided (1) that "material handling" in the preamble of '125 claim 1 was not a limitation; (2) that the "fin extending from an underside of said car and lengthwise of said car" in '125 claim 1 meant a "fin extending from an area under the chassis of a car (e.g., the part of the car to which the wheels are mounted) in the direction of the length of said car;" (3) that "change the spaced apart relationship" in '237 claim 1 meant relative motion between the walls and magnet arrays in any direction; and (4) that "as a function of velocity of the member between the arrays" in '237 claim 3 meant that "the 'apparatus' in claims 1 and 10 is capable of adjusting eddy current and braking force in a way that depends on the velocity of the 'member' between the first and second 'arrays' of magnets." (A000809, A000811, and A000815-A000816).

The district court approved a Report and Recommendation by the magistrate judge assigned to the case. (A011087-A011161 and A000001-A000012). The district court granted: (1) the defendants' motion for summary judgment of invalidity of claim 3 of the '125 patent on four grounds; (2) summary judgment of non-infringement of claim 3 in part; and (3) summary judgment of non-infringement of claims 1 and 10 of the '237 patent. (A000001-A000012 and A011087-A011161).

The district court also excluded the plaintiffs' technical expert's report. (A000001-A000012 and A011017-A011039).

V. SUMMARY OF THE ARGUMENT

There are disputed issues of material fact whether claim 3 of the '125 patent is indefinite because it refers to a pair of rails as "tracks." Testimony by a knowledgeable witness, the defendants' technical expert's report, the district court's claim construction, the claim itself, and the prosecution history demonstrate that "tracks" is a synonym for "rails."

Testimony from a knowledgeable witness raises a disputed issue of fact about whether Kwangho Chung was an inventor of the '125 patent. Chung's contribution was to tell the '125 inventors about motor stators that everyone, including Chung, agreed were known in the prior art.

There were disputed issues of fact about whether the invention of claim 3 of the '125 patent was sold before the critical date, because the document relied upon by the district court was a sale of conceptual design and development services, not the sale of a product as required by *Pfaff v. Wells Electronics, Inc.*, 525 U.S. 55, 67 (1998).

There was a disputed issue of fact about whether claim 3 of the '125 patent was obvious. The combination of references lacked elements of the claim. There was evidence against a motivation to combine. The court gave no weight to the prosecution history of the patent, even though no error exists in the history, and even though the examiner considered art better than that offered by the defendants.

Even without the plaintiffs' expert's report, there was sufficient evidence to show at least disputed issues of fact regarding the rides alleged to infringe the '125 patent under the doctrine of equivalents. The defendants' manuals for the brakes on their roller coasters showed that the ride structures accused under the doctrine used the same principle of operation, in the same way, to achieve deceleration of a roller coaster car.

There were disputed issues of fact regarding infringement of the '237 patent. The defendants' documents, testimony, and interrogatory responses show by a preponderance that eight rides infringe. That is true even without considering the evidence in the plaintiffs' expert report. The defendants offered no response except attorney argument and a conclusion by their expert.

The court abused its discretion in excluding plaintiffs' expert report. The court said the expert, Mark Hanlon, was qualified. Hanlon used his knowledge and experience to point to the necessary structures in the drawings and photographs describing the defendants' roller coaster rides. Where additional analysis of functional elements was required, the court said he provided it. Hanlon provided his reasoning and the facts he relied on, including the defendants' brake manuals, to show that a group of rides infringed under the doctrine of equivalents. His report complied with *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

VI. ARGUMENT

A. THE STANDARDS OF REVIEW

Summary judgments are reviewed *de novo. EMD Millipore Corp. v. AllPure Techs. Inc.,* No. 2014-1140, slip op. at 6 (Fed. Cir. Sept. 29, 2014) citing *Innogenetics, N.V. v. Abbott Labs.,* 512 F.3d 1363, 1378 (Fed. Cir. 2008). Clear and convincing evidence is required for a summary judgment of invalidity. *Microsoft Corp. v. i4i Ltd. P'ship,* 131 S. Ct. 2238 (2011). In order for a grant of summary judgment of non-infringement to be upheld on appeal, the district court must have correctly concluded that no reasonable jury could find infringement after resolving reasonable factual inferences in favor of the patentee. *Absolute Software, Inc. v. Stealth Signal, Inc.*, 659 F.3d 1121, 1130 (Fed. Cir. 2011); *see also AFG Indus., Inc. v. Cardinal IG Co.*, 375 F.3d 1367, 1371 (Fed. Cir. 2004) ("[A] trial court cannot reach a conclusive finding of noninfringement if the record shows some evidence supporting a finding of noninfringement and some evidence to the contrary.").

Regional circuit law applies to procedural matters not unique to patent issues. *Panduit Corp. v. All States Mfg. Co.,* 744 F.2d 1564, 1574-75 (Fed. Cir. 1984). The Third Circuit reviews exclusion of an expert report for abuse of discretion unless the lower court was also interpreting a federal rule; in that case, the review is plenary. *Oddi v. Ford Motor Co.*, 234 F.3d 136, 146 (3d. Cir. 2000).

B. THERE WERE DISPUTED ISSUES OF MATERIAL FACTS REGARDING VALIDITY OF THE ‘125 PATENT

1. Claim 3

The text and the pictures in the ‘125 patent show a car running on a track having two rails, with magnet assemblies between the rails. (A000092, A000088, and A000091, ‘125 patent, col. 5, lines 18-21, fig. 2A, and col. 4, lines 13-14).

Claim 3 recites a car running on a track with rails, with a car having wheels riding on the rails, with a fin on the car passing between a gap in magnet assemblies “between said tracks.” (A000093, ‘125 patent, col. 7, line 3 to col. 8, line 12).

Claim 3 reads:

> 3. Material handling car and track assembly, said assembly comprising:
>
> a car having wheels mounted thereon, and
>
> a track having two parallel rails, said wheels being adapted to roll on said rails to facilitate movement of said car along said track,
>
> a metal fin extending from an underside of said car and lengthwise of said car, and
>
> opposed magnet assemblies mounted between said tracks,
>
> said opposed assemblies being spaced from each other by a distance exceeding the thickness of said fin to define a gap between said magnet assemblies,
>
> said fin being adapted to pass through said gap in travel of said car over said magnets,
>
> each of said assemblies comprising a mounting bracket, a plate attached to said mounting bracket, and a series of magnets bonded to said plate,
>
> said magnets on said plate being disposed side by side in a direction of travel of said car on said rails,
>
> said magnets being operative sequentially to act on said fin to impart braking to said car.

(A000093 and A000095-A000097, ‘125 patent, col. 7, line 3 to col. 8, line 12 and Certificates of Correction).

2. There were disputed facts regarding whether there was any error in claim 3 of the '125 patent

The court found that claim 3 was indefinite because it contains an error; it refers to "opposed magnet assemblies mounted between said tracks" rather than "between said rails" in the fourth clause of claim 3. (A011090-A011095). The court said the plaintiffs conceded the error, but they did not. Their argument was titled "There Is No Fatal Error In Claim 3." (Compare A011094 with A010146-A010148).

Joel Staehs, an engineer and one inventor of the '125 patent, said that he understood what the claim meant, that is, that "tracks" means a pair of rails:

> Q. Right. But then–then the magnets are between said tracks. They're between the tracks. They're not between the rails.
>
> A. Oh, semantics. Oh, my goodness. I mean, that–I don't see any problem with that. I mean, a railroad track has got two rails. A telecar track has got two rails. The track is made up of two rails.
>
> Q. But the claim doesn't say between the rails. It says, Between [sic] said tracks, right?
>
> A. Well, ***I'm a technical kind of guy,*** and to me that's–***there's no problem with that. I mean, everybody knows that a track has two rails.***
>
> Q. Right. But that's not–that's not what the claim actually says. It says, Between [sic] said tracks. It could say–it could have been written differently and say, Between [sic] said rails. But it doesn't say that.
>
> A. Okay. All right. Okay. All right. Maybe rails would have been better, but I–***I knew what it meant.***

(A010176, emphasis added).

The defendants' expert, Kirtley, used the same terminology; he described a "prior art system us[ing] linear motor stators and permanent magnets lying flat between ***a pair of tracks***" and to a "car that rolled on the ***tracks***." (A010570, emphasis added). He described a patent as "a material handling car that runs on a guideway including ***tracks***." (A010573 at ¶ 114, emphasis added).

The examiner rejected application claim 10 (which issued in amended form as claim 3) as obvious, but not as indefinite. (A010224-A010225 and A010258-A010259 at ¶ 6).

A claim is indefinite if it "fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2123 (2014). Staehs understood the claim. His understanding is corroborated by the defendants' expert, and by the actions of the Patent Office.

A claim term is to be read in the context of the rest of the claim. *Microprocessor Enhancement Corp. v. Tex. Instruments Inc.*, 520 F.3d 1367, 1375 (Fed. Cir. 2008) ("condition code" in claim had two meanings; use of a term with an antecedent does not require that both terms have the same meaning). "The appropriate meaning of 'condition code' is readily apparent from each occurrence in context." *Id.* at 1376.

Claim 3 refers to a car with wheels riding a track with parallel rails, the car having a fin that passes between magnet assemblies mounted "between said tracks." The context of the claim makes clear what "tracks" means. The specification and drawings are consistent, and show what is meant. Staehs, the defendants' expert, and the patent examiner all used "tracks" as a synonym for "rails" or "pair of rails."

This uncontradicted evidence at least established a disputed fact issue.

3. There were disputed facts regarding whether Chung was an inventor of the '125 patent

The district court concluded that Chung was an inventor because he was responsible for the facing stators recited in unasserted claim 1 of the '125 patent. (A000008 and A011095-A011103). A stator is the stationary part of a motor. (A000091, '125 patent, col. 4, lines 21-22 and 52-54). Claim 3 does not recite a stator or a motor. (A000093, '125 patent, col. 7, line 3 to col. 8, line 11).

Staehs said that Chung used two facing stators in the 1960's. (A011098). That is twenty years before the '125 patent application was filed. (A000086). Chung said his idea was old:

> Well, it's in the books in here and there, I guess. So I cannot pin down exactly who is my–who is my source of information on that, but I assume that all along it's more of a prior art–prior art, nothing more than that. I don't claim I invented it.

(A006992, citing A007316-A007317).

The examiner of the '125 patent application said that the use of facing stators was old. (A010257 at ¶ 4). The applicant agreed by amending the claims. (A010262-A010272).

The inventors named in an issued patent are presumed to be correct. *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997). The burden of proving otherwise is clear and convincing evidence, because there is a temptation for even an honest person to recall events more favorably to his own role. *Id.*

The inventors in *Hess* were looking for a new material for a catheter because the material they tried was no good. *Id.* at 977. Hess told the inventors how use Raychem tubing, and to use an adhesive-free seal to avoid toxic adhesive. *Id.* Hess said what he taught the inventors could be found in books. *Id.* Hess met with the inventors, provided samples, and suggested approaches to the construction of the catheter. *Id.* at 977-78.

Hess sued, alleging he was an inventor. *Id.* at 978. The court held that inventors could use the services, ideas and aid of others, citing *O'Reilly v. Morse,* 56 U.S. (15 How.) 62, 111 (1853) and *Shatterproof Glass Corp. v. Libbey-Owens Ford Co.,* 758 F.2d 613, 624 (Fed. Cir. 1985). *Id.* at 981. Describing to the inventors what was available, and telling the inventors how to use it, did not make Hess an inventor. *Id.*

The evidence from Staehs and Chung is that Chung provided something that was known. Chung said it was in the books. There is at least a factual dispute whether Chung is an inventor.

The district court gave great weight to Chung's testimony that he had to persuade the company to use motors, that he was the only person advocating it, that he stuck his neck out, and that he proved it by testing. (A011101-A011102). But there is not one document showing Chung testing anything, or advocating to anyone opposed to his idea, or sticking his neck out. A purported co-inventor must be corroborated. *Checkpoint Systems, Inc. v. All-Tag Security S.A.,* 412 F.3d 1331, 1339 (Fed. Cir. 2005) (citing cases including *The Barbed-Wire Patent*, 143 U.S. 275, 284 (1892)). Testimony by the alleged co-inventor is not enough. *Id*. "Reliable evidence of corroboration preferably comes in the form of physical records that were made contemporaneously with the alleged prior invention." *Trovan, Ltd. v. Sokymat SA*, 299 F.3d 1292, 1302 (Fed. Cir. 2002). Chung is uncorroborated. A finder of fact could reasonably conclude that Chung was inflating his role.

4. There were disputed facts regarding whether the invention of claim 3 of the '125 patent was sold

BAE and the city of Denver signed a contract in May 1992 for a baggage system at the new Denver airport. (A010362). That is more than six months after the critical date of the ‘125 patent. The price was $195,600,000. (A010364). The system still did not work. (A002180-A002181).

The district court concluded that the apparatus in claim 3 was not sold to Denver before the critical date, but was sold to United Airlines because of BAE’s August 1991 Engineering Services Proposal to United Airlines. (A011103-A011115).

That proposal was for design of a system, not the sale of a product. It did not include a system price, or specifications, or a delivery date. The design was fluid and incomplete.

The Engineering Services Proposal said its goal was “to develop and design a baggage system….” (A008753 and A011106). A subsequent letter said the Proposal was an “analysis of dates, events and manpower required to successfully deliver an operational system.” (A008828). The City of Denver said that it had “entered into a professional engineering services contract with the Consultant [BAE] for conceptual design work” for the baggage system. (A010324). There would be no “[f]rozen system configuration and specifications” until January 1992. (A008795 and A011110). United paid for design services, not a system: “UAL Issues A/E Service Agreement ***to begin design*** of its DIA system.” (A008812 and A011114).

There was good reason to believe design work would be required. Any airport system would include 62,000 feet of track and conveyors, 3,500 cars, and 5,200 motors. (A010184-A010185 and A008754). That list of components in the Proposal does not list any magnets. *Id.* The prototype system had six cars and 1,500 feet of track. (A010177-A010178, A010180-A010181, A008798, and A010192). Prototype components would not be used in Denver. (A010192-A010193). The prototype system was floor-mounted; the system for Denver had to be ceiling-mounted because the floors there would not accept the load. (A010188-A010189). Denver was "a completely different type of problem." (A010189). The Proposal estimated that 1,049,000 man-hours would be required to design the system. (A008754).

There was no price in the Engineering Services Proposal. (A011110 and A008750-A008792). The Proposal only estimated man-hours, that is, services. (A011110 and A008754). One month later, BAE "declin[ed] to submit a bid" and told Denver that it was "impossible" to provide a firm price before January 6, 1992. (A011110-A011111 and A008811-A008826). Four days prior to the critical date in late October 1991, there was no price that anyone could accept. The supplier estimated the cost at somewhere between $144 million to $194 million. (A010191, A011111-A011112 and A008836-A008841). The supplier said "One of the reasons for suggesting this range was BAE's knowledge that United's portion of the system ***was still under active study and was missing elements*** which would have to be added as work progressed." (A011111 and A008837, emphasis added). No price existed until May 1992. (A011113 and A010362-A010364).

Claim 3 is for a product, not a service. *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 67 (1998) (A "product must be the subject of a commercial offer for sale."). There is no offer for sale of anything unless the only thing the offeree need do is say "I accept." *Group One, Ltd. v. Hallmark Cards, Inc.*, 254 F.3d 1041, 1048 (Fed. Cir. 2001) held that "[o]nly an offer which rises to the level of a commercial offer for sale, one which the other party could make into a binding contract by simple acceptance (assuming consideration), constitutes an offer for sale under § 102(b)."

The district court said there was no sale to Denver until 1992. (A011115). The work with the city was for engineering services. *Id*. The court said that a November 12 letter said that "[a]ll parties to our discussion recognize that the system's configuration *remains somewhat fluid*." (*Id.*, emphasis in original and A009232-A009233). The contract for "conceptual design work" was entered into on the next day. (A011115). A sale of a system whose design was fluid and missing elements gives rise to a factual dispute about a sale. Plaintiffs were entitled to that inference. Design services, not products, were being provided to Denver and United.

No reasonable person was going to say "I accept" to a document that contained no price. No reasonable person was going to say "I accept" to a document that estimated that 1,049,000 man-hours would be required to design a system that had forty times more track and conveyors, and five hundred times more cars, than the prototype. The plaintiffs were denied the benefit of those reasonable inferences.

5. There were disputed facts regarding whether claim 3 was obvious

The district court concluded that claim 3 was obvious based on two combinations: the Miller patent in view of the Demukai patent, and a prior art BAE system in view of Demukai. (A011124).

Miller depicts a mechanical friction brake that is used "to gradually check the speed where necessary and for smoothly and gradually bringing cars to a stop at the end of a trip." (A010632, first col., lines 4-6). Miller's invention must be able to stop a car.

A magnetic brake cannot stop a car. The generation of an eddy current–the braking force–requires relative movement of the fin with respect to the magnets. (A010576, A010657-A010658, A011119 and A009162-A09163). The braking force drops as the car slows. Jasper, Cedar Fair's Corporate Vice-President for Safety and Engineering and Rule 30(b)(6) designee, said:

Q. Okay. Can you bring a train to a halt with a magnetic brake?

A. No, you can't.

(A011119 and A009163).

The defendants' expert agrees: "The energy must come from the motion of the conductor and so a retarding force, opposing that motion, is produced." (A010569 at ¶ 26).

That is why the '125 patent says the magnetic brake "decelerates" a car, not "stops" a car. (A000092, '125 patent, col. 5, lines 22-42). That is why Veraart, a reference in the '125 history, says that permanent magnets can "slow" a vehicle. (A010615, col. 2, lines 51-56).

The district court concluded that one of skill would be motivated to substitute "magnetic retarders" for the friction brakes in Miller. (A011122). The result, according to the court, would be a "contactless" braking system. *Id.* But no contact means no stopping, and Miller says that his brake must to be able to stop a car. Retarding is not stopping. No one provided any reason why an engineer would make a combination that makes it impossible to stop a vehicle.

The other combination is Miller in view of the prior art BAE system. (A011122-A011123). Substituting the magnets of the earlier BAE system would do the same as the Demukai combination: prevent the Miller device from stopping a car. No one explained why any sensible person would make that combination.

A reason to combine is required, even where there is a *prima facie* case for obviousness. *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors USA, Inc.*, 617 F.3d 1296, 1303-04 (Fed. Cir. 2010); *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1366 (Fed. Cir. 2012) (Evidence of motivation to combine still needed even if the references contain all the limitations of the claim). Whether there is a reason to combine references is a question of fact. *Id.* at 1367.

The defendants' expert said that in his "opinion, it would have been obvious to one of ordinary skill in the art at the time of the application for the '125 patent to substitute magnetic retarders operating on a fin passing between them, as shown in Demukai, for the friction brakes acting on a fin passing between them, as in Miller." (A011116-A011117 and A007048-A007050 at ¶¶ 92-97). His only reason was that "[o]ne would have been motivated to make this substitution in order to, for example, employ a contactless braking system that would not have worn out as the friction brakes would have." (A007050 at ¶ 92-97). He says nothing about how the combination could stop a car, as Miller requires.

Innogenetics, N.V. v. Abbott Laboratories, 512 F.3d 1363 (Fed. Cir. 2008) approved exclusion of an expert because he "merely lists a number of prior art references and then concludes with the stock phrase 'to one skilled in the art it would have been obvious to perform the genotyping method in [claims 1-9 & 12-13] of the '704 patent.'" *Id.* at 1373 (alteration in original). *Innogenetics* continued:

> [T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

Id. (quotation marks omitted) (alteration in original) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) and *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007)).

In *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984) the Board held that a prior art filter could be inverted, making the invention obvious. The appellate court reversed the Board because inverting the prior art filter frustrated its use of gravity to separate fluids. *Id.* In *Ex Parte DeJean*, No. 2010-3296, 2012 Pat. App. LEXIS 2344, at *6 (B.P.A.I. May 8, 2012) the Board held that the proposed combination would render inoperable the prior art reference being modified. It quoted MPEP Section 2143.01: "[I]f [a] proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *Id.* at *6. (alterations in original) There was no *prima facie* showing of obviousness. *Id.* at *7.

Kirtley says nothing about the problem presented by his combination. He has no articulated reasoning or rational underpinning to account for the contradictory evidence: The operation of Miller is degraded and frustrated, not improved, by substituting the magnets from Demukai or the BAE system. That evidence must be considered.

There was no *prima facie* obviousness, either. Three elements of claim 3 are missing from Miller: the mounting bracket, the plate attached to the mounting bracket, and magnets bounded to the plate. (A006344 at row 8). The district court omitted any discussion of the mounting brackets, part of the magnet assemblies between the tracks, recited in claim 3. Miller has no such brackets. Instead, Miller uses a lever to move a "movable beam 18" toward "stationary [brake] beam 14 to squeeze the brake shoe." (A010633 at left col., lines 15-20). Miller's brake works only when there is *no* gap. The brake of claim 3 is effective only because there is *always* a gap, through which the fin or slider on a car passes. The defendants do not address this difference.

Thompson said that given differences between the Demukai sliding door and the car-and-track magnetic brakes in claim 3 of the '125 patent, one of ordinary skill would not combine Miller and Demukai. (A006599). Thompson was asked, "All right. So let's ***suppose*** that one wanted to apply the magnetic braking of Demukai to a system like Miller." (A011121, emphasis added). That is the assumption that Thompson said was not reasonable. (A006599). ***Assuming*** that one wanted to combine Demukai and Miller, Thompson answered questions about back iron and larger magnets. There is no evidence Thompson was asked whether he agreed with that assumption, or whether it altered his opinion that the combination was not reasonable.

Obviousness cannot be based on an assumption that references would be combined, when the witness says that the assumption is not reasonable. And in any case there is no evidence about the mounting brackets limitation, nor is there any evidence of a reason to combine Miller and Demukai.

The district court faulted Thompson for having no opinion about BAE and Demukai. (A011122-A011123). But there was nothing for Thompson to rebut. The paragraphs (¶¶ 135 to 140) cited by the defendants from their expert's report only describe the BAE system. Those paragraphs say nothing about Demukai. (A006357-A006358). That should have been the end of it. It was the defendants' job to carry their burden.

The plaintiffs had the presumption of validity, backed up by intrinsic evidence, the history of the '125 patent. 35 U.S.C. § 282 (2014); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1317 (Fed. Cir. 2005) (*en banc*). The examiner rejected application claim 10 (issued claim 3) as obvious. (A010258-A010259 at ¶ 6).

One reference, Japanese '804, showed a conveying vessel 8, wheels 9, and a conductor 3. (A010257-A010259 at ¶¶ 5- 6 and A010580-A010586). A second reference, Japanese '105, taught a parallel track configuration. (A010257-A010258 at ¶¶ 4-5 and A010588-A010595). The combination showed everything in claim 10 except for a non-metallic fin, which was shown in a third reference, Matsuo. (A010258-A010259 at ¶ 6 and A010597-A010605).

The examiner also cited Veraart's U.S. Patent 5,127,599 as using permanent magnets. (A010259 at ¶ 7). Veraart's permanent magnet is flat on the track, like the earlier BAE systems. (A010607-A010619 and A009218-A009230).

The examiner considered references that were as good or better than Miller, Demukai, and prior BAE systems. An examiner is a trained, quasi-judicial official who has expertise in the art, and whose duty is to issue valid patents. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 986 (Fed. Cir. 1995), *aff'd,* 517 U.S. 370 (1996). The '125 patent issued because a competent, impartial examiner did his or her statutory job. The '125 file history was evidence contradicting the defendants, and it created a factual dispute by itself.

There were disputed issues. The first was whether any motive existed to combine Miller with either Demukai or a BAE system. The second was the failure of the combination to include all the elements of claim 3. The third was whether to believe the evidence of the file history rather than that offered by the defendants' paid expert.

6. Secondary considerations merited an inference favoring the plaintiffs

The district court accused the plaintiffs of being inconsistent in down-playing Chung's work while quoting the COO of Six Flags, who said "[t]he application of the linear induction launch coaster, along with the invention of the magnetic brake system, has truly rescaled the topography of roller coasters.… This has allowed for the creation of the mega launch coaster….” (A010646 and A009170-A009179). The district court discarded this evidence. But there was no inconsistency. No one argued that Chung was an inventor of claim ***3***. The district court confused his facing stators in claim ***1***–parts of a motor–with the magnetic brakes of claim ***3***. (A011124).

The district court quoted *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1311-12 (Fed. Cir. 2006) that says “if the feature that creates the commercial success was known in the prior art, the success is not pertinent.” *Id.* (Footnote omitted). The district court mistakenly relied on Chung’s contribution of an old idea to claim 1. The Six Flags COO referred to the “invention of the magnetic brake system,” not to Chung’s stators. Numerous Six Flags coasters were accused of infringement. The plaintiffs were entitled to a favorable inference.

C. THERE WERE DISPUTED ISSUES OF MATERIAL FACTS REGARDING WHETHER THE ‘125 PATENT WAS INFRINGED

The district court said claim 3 was not infringed with respect to a number of roller coasters. (A011131-A011142). These rides were accused under the doctrine of equivalents because the fins were mounted to the track structure, not to the car.

The court held that these rides did not infringe because it excluded the plaintiffs' expert's report. (A011135 and A011140-A011141).

There was a factual dispute even with the exclusion of the plaintiffs' expert. The defendants' "Eddy Current Magnetic Brake 'Fixed' Manual" specifies that the same magnetic brake can be used in either of two configurations. [redacted]

- The brake assemblies can either be installed on the vehicle or in the guide way.
- The brake fins are then respectively installed either in the guide way or on the vehicle. The brake fins consist of a non-magnetic electrical conductor.
- [redacted]
- [redacted]

(A008166 and A006389). Thirty-seven rides use the Intrasys brake. (A006389, A006393, A006401, A006405, A006409, A006416, A006421, A006425, A006431, A006437, A006457, A006460, A006468, A006471, A006481-A006482, A006484, A006488, A006491, A006495, A006498, A006501, A006505, A006507, A006509-A006510, A006512, A006515, A006517, A006521, A006524, A006526, A006529, A006531, A006534, A006536, A006544, A006547, A006550, and A010025-A010027).

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Infringement under the doctrine of equivalents is a fact issue. *Sage Prods., Inc. v. Devon Indus., Inc.*, 126 F.3d 1420, 1423 (Fed. Cir. 1997). It can only be decided on summary judgment if *no* reasonable fact-finder could find equivalence. *Id.* Equivalents are judged by function, way and result. *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608 (1950). The function here is braking. The way is eddy currents generated by a fin moving through a magnetic field. The result is that the car is slowed.

There is no claim construction here that precludes application of the doctrine. Every limitation is present; there is still a magnet assembly, and a fin. There was no vitiation of a limitation. *Brilliant Instruments, Inc. v. Guidetech, LLC*, 707 F.3d 1342, 1347 (Fed. Cir. 2013) ("Rather, vitiation applies when one of skill in the art would understand that the literal and substitute limitations are not interchangeable, not insubstantially different, and when they do not perform substantially the same function in substantially the same way, to accomplish substantially the same result.").

Here, the defendants *do know* of the interchangeability of the positions of the magnet assembly and fin. They possess the Intrasys brake manual. They frequently use the interchanged arrangement in their rides. They know that the difference is insubstantial, and that it performs the same function in the same way to get the same result. Even without the plaintiffs' expert, there was a factual dispute.

The plaintiffs' expert report provided facts supporting the conclusion that infringement existed. The expert said:

> In my opinion, the only requirement of these elements that is not literally present is a fin "extending from an underside of said car." The fin extends from the track structure instead of from the car. However, instead of the fin, opposed magnet assemblies extend from an underside of the car. The opposed magnet assemblies are mounted between the tracks, on the cars. I note that the claim does not require the magnets to be mounted on the tracks, only between the tracks. The magnets are between the tracks in this configuration. There is a metal fin, it is under the cars and is lengthwise of the cars, only it is attached to the track. The structural difference is that the fin and magnets are inverted 180 degrees (vertical). In my opinion, this is an equivalent, for the following reasons.
>
> The inverted configuration of magnets extending from an underside of the car, working together with a fin mounted on the tracks, is not substantially different from a fin extending from an underside of the car, working together with magnets attached to the tracks. The inverted configuration performs the same function, which is to allow the fin to pass between the opposed magnet assemblies. In the inverted configuration, the magnets and fins work together in substantially the same way to achieve the result of braking the car. The magnets move with the cars while the fins remain stationary. In the "Traditional" configuration when the fin is extending from an underside of the car, the fins move and the magnets are stationary. However, this is not a substantial difference because eddy currents are induced in the fin when the magnets move past the fin, in the same way that eddy currents are induced when the fin moves through the magnets in the "Traditional" configuration shown in the '125 patent and found in other rides. Both configurations achieve the same result, which is to apply braking force to the car.

(A006387-A006389). He quoted and relied on the manual quoted above. (*Id.* and A008166).

There was a factual dispute regarding infringement under the doctrine of equivalents.

D. THERE WERE DISPUTED ISSUES OF MATERIAL FACTS REGARDING WHETHER THE ‘237 PATENT WAS INFRINGED

Claim 1 of the ‘237 patent reads:

> 1. An eddy current brake comprising:
>
> a diamagnetic or non-magnetic member;
>
> a first support wall;
>
> a separate second support wall disposed in a spaced apart relationship with said first support wall for enabling the member to pass therebetween;
>
> a first linear array of permanent magnets disposed on the first wall on a side of the first wall facing the second wall;
>
> a second linear array of permanent magnets disposed on the second wall on a side of the second wall facing the first wall, the first and second arrays being parallel with one another; and
>
> apparatus for adjusting eddy current induced in the member, and braking force, as a function of velocity of the member between the arrays, said apparatus including linkages for enabling movement of the member therepast to change the spaced apart relationship between the first and second walls.

(A000105-A000106, ‘237 patent, col. 6, line 56 to col. 7, line 8). Claim 10 eliminates references to walls, and says that the magnet arrays are spaced apart. (A000106, ‘237 patent, col. 8, lines 28-41).

The district court concluded that there was no evidence that the rides adjusted the braking force as a function of velocity of the member between the arrays, or that the rides had linkages for enabling movement of the member therepast to change the special relationship between the walls. (A011159).

The magistrate judge's Report and Recommendation (A011087-A011161) does not mention the claim construction that was done by the district judge. The latter construed "change the spaced apart relationship" to mean relative motion between the walls and magnet arrays in any direction. (A000815). The district judge construed "as a function of velocity of the member between the arrays" to mean that "the 'apparatus' in claims 1 and 10 is capable of adjusting eddy current and braking force in a way that depends on velocity of the 'member' between the first and second 'arrays' of magnets." (A000816). There was no construction regarding the linkages.

Eight rides were accused of infringing claims 1 and 10. The defendants' ride manuals show that they all use magnetic brakes. (A009734-A009741; Apocalypse and American Thunder, A009380-A009381, A009386-A009387, A009389-A009421, and A002951-A002983; Prowler, A003136-A003138 and A003096-A003128; Dark Knight and El Toro, A009384, A006030-A006062, A003088-A003094, A009397, A009400-A009401, and A009410; The Green Lantern, A009385 and A006030-A006062; The Spinning Dragon, A003099, A003104, A003136, and A009551-A009556; New Texas Giant, A009558-A009562 and A009573-A009577). All of the brakes have one magnet array that can move relative to the other array. *Id.* The defendants admitted that the "[redacted]" (A003436, A009734-A009741, A009558-A009562, A009573-A009577, A003136-A003138, A009508-A009549, and A009551-A009556). All of the accused rides satisfied the relative movement limitation.

The court Report and Recommendation read a limitation into the claim. It accepted the defendants' argument that the ride brakes were not "self-regulating," that is, causing movement by magnetic forces, instead of mechanical means, such as pneumatic pistons. (A011157-A011158).

But neither claim 1 nor claim 10 requires that the apparatus be self-regulating. The '237 patent describes other ways to move a wall or array:

> It should be appreciated that the apparatus 140, 142 may include any number of configurations for adjustment of the walls 104, 106. Such alternatives including single direction bolts, worm screws, jack screws, short in-line turn buckles, or other electrical, pneumatic, hydraulic system capable of providing the adjustment of spacing D, between the walls 104, 106.

(A000104, '237 patent, col. 4, lines 37-43, discussing figs. 6 and 7). The '237 patent says that "object 52 and fin 54 are provided with means 60 selectively actuatable for moving them toward the magnet carrier so as to effect magnetically coupling therewith (FIG. 5) and achieve braking." (A000104, '237 patent, col. 3,

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lines 61-64, discussing figs. 4 and 5). Construing claims to exclude preferred embodiments is rarely acceptable. *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583-84 (Fed. Cir. 1996). The Report's limitation of the claims to movement by magnetic attraction excludes embodiments in the specification. The Report did not mention these embodiments.

The other dispute was whether the braking force was adjusted in a way that depended on the velocity of the member between the magnet arrays on the walls. The defendants argued that the accused rides sense velocity of the car at some point upstream of the brake and move one brake wall laterally with respect to the other, to either activate or deactivate the brake by aligning or misaligning the magnetic poles. (A003436 and A009687-A009688). The defendants claimed that there was no relationship between braking and velocity, because the car could slow down or speed up after the sensor and before the brakes, but the braking force still would not change. *Id.* The defendants provided no evidentiary support for the argument. They did not provide evidence of changes in speed between any sensor and brake. There is no evidence whether any sensor is ten inches or ten feet from any brake.

Neither claim 1 nor claim 10 recites measurement of velocity. Neither recites that the entire apparatus for adjusting be entirely located at the brake. Neither claim prohibits adjusting an eddy current and braking force by turning it on or off as opposed to a gradual variation. What the claims do require is an "apparatus for adjusting," and that the adjustment be "as a function of velocity" between the walls or arrays. (A000106). The district judge construed this limitation to mean that "the 'apparatus' in claims 1 and 10 is capable of adjusting eddy current and braking force in a way that depends on velocity of the 'member' between the first and second 'arrays' of magnets." (A000816).

The defendants argued:

[redacted]

(A009687-A009688, emphasis in original). There was no evidence, only attorney argument, about "some other point" or its location.

The defendants' explanation is fallacious. If the speed is too high at the sensor, it should activate the brake to slow the car as it passes the brake. But if a car slowed, as the defendants suggest, after the sensor and before the brake, the sensor's command (to brake) would be unchanged and incorrect; the brake would still activate and further slow the car less than the desired speed.

If the speed at the sensor is not too high, the sensor should inactivate the brake, so the car will not slow too much. If, however, as the defendants argue, the car sped up after the sensor and before the brake, the sensor's command would be

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unchanged, and the car would be going too fast when it arrived at the brake, which would still be inactivated. Even if there is a sensor, to function correctly it must sense a speed substantially the same as the speed at the brake.

The braking force therefore is adjusted "in a way that depends on [the] velocity of the 'member'" between the magnet arrays. (A000816).

The defendants' documents confirm that the speed at the brake is governed. Their brakes are "[redacted]"; they are "[redacted]"; the brake will be turned off "[redacted]"; and the magnetic braking system "[redacted]" (A003149-A003150, A003152, A003154, A003374 at second bullet under b, A006039, and A003422). The brakes can be turned off to make the braking force negligible. (A009523). The defendants say that the ***braking system*** regulates speed. In each case, the defendants' brakes adjust the braking force in a way that "depends on velocity of the 'member' between the first and second 'arrays' of magnets." (A000816).

The adjustment is a function of velocity between the walls or arrays for a second reason. The characteristic of an eddy current brake is that the greater the velocity is, the greater the resultant eddy current and braking force will be. (A000104, '237 patent, col. 3, lines 41-43 and A008592-A008593). When the brake is on, a faster car moving through the brake will cause larger eddy currents

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and a greater braking force. Again, the braking force varies in a way that depends on the velocity between the arrays.

The evidence shows that "the 'apparatus' in claims 1 and 10 is capable of adjusting eddy current and braking force in a way that depends on velocity of the 'member' between the first and second 'arrays' of magnets." (A000816).

The plaintiffs' evidence shows infringement. The defendants provided attorney argument. There was at the very least a factual dispute.

E. THE DISTRICT COURT ABUSED ITS DISCRETION IN EXCLUDING THE PLAINTIFFS' TECHNICAL EXPERT

The court excluded the plaintiffs' technical expert. (A000001-A000012 and A011017-A011039). The court found that the expert, Mark Hanlon, was qualified to offer expert testimony regarding "whether the accused products contain all of the limitations in an asserted claim." (A011027). The court excluded three aspects of Hanlon's opinion: (1) that numerous amusement rides literally infringe claim 3 of the '125 patent; (2) that some rides literally infringe claims 1 and 10 of the '237 patent; and (3) that for some rides, one of the limitations of claim 3 of the '125 patent is met by the doctrine of equivalents. (A011028-A011029 at n. 63-64 and A011036 at n. 78). The court excluded Hanlon for a lack of "analysis." (A011032-A011033, A011035-A011036, and A011038-A011039).

Expert testimony under Rule 702 must meet the basic requirements of: (1) qualification, (2) reliability, and (3) fit. *United States v. Mitchell*, 365 F.3d 215, 245 (3d Cir. 2004). The Third Circuit liberally interprets the qualification requirement of Rule 702. *In re Paoli R.R. PCB Yard Litig.*, 35 F.3d 717, 741 (3d Cir. 1994); *Roche Diagnostics Operations., Inc. v. Corange Int'l Ltd.*, No. 07-753-JJF, 2010 U.S. Dist. LEXIS 8093, at *4 (D. Del. Jan. 29, 2010). "Rule 702's liberal policy of admissibility extends to the substantive as well as the formal qualification of experts," and the Third Circuit has "eschewed imposing overly rigorous requirements of expertise and … been satisfied with more generalized qualifications." *In re Paoli*, 35 F.3d at 741.

The reliability inquiry under Rule 702 is a flexible one. *See Pineda v. Ford Motor Co.*, 520 F.3d 237, 248 (3d Cir. 2008); *Gallentine v. Estate of Stekervetz,* 273 F. Supp. 2d 538, 542 (D. Del. 2003) ("[T]he reliability inquiry must be a flexible one"). When the facts of the case so dictate, the reliability of testimony may be based on personal experience rather than scientific methodology. *See Gallentine*, 273 F. Supp. 2d at 542; *see also Cantor v. Perelman*, No. 97-586-KAJ, 2006 U.S. Dist. LEXIS 86329, at *23 (D. Del. Nov. 30, 2006) ("[E]xperts may base their testimony upon personal experience.").

1. Hanlon's literal infringement opinions are supported and reliable

Hanlon's report provides statements about the analysis he did, and provides, on an element-by-element basis for each ride, an opinion that each element is present, citing all the evidence for that conclusion.

Nearly all the claim elements only require basic structures: cars, wheels, metal fins, magnets, brackets, and support walls. The presence or absence of each is a plain, objectively verifiable fact. (*See, e.g.*, A011030-A011031 and A011034-A011035, citing excerpts of Hanlon's report for "El Toro"). For the two claim elements that are more complicated because they have substantial functional requirements ('237 claim 1(f) and 1(g), claim 10(e) and 10(f)), the court said that Hanlon *did* provide additional "analysis." (A011035 and A011037-A011039).

Hanlon's opinions that the elements literally exist on the rides do not have to be "analyzed" any more than his report states. His conclusions cannot be faked, and if incorrect, there is no way for his opinions to evade challenge by defendants. *Daubert* was satisfied.

Hanlon describes what he did in reaching his conclusions that the accused rides have the claim elements. Hanlon used his qualifications and experience to review and analyze voluminous documents and other discovery that relate to the objectively verifiable facts at issue. First, he is qualified to identify the claimed components on the infringing rides. (A011027). Second, he identified his process.

He reached his conclusions after "reviewing documents, testimony and other evidence about the accused amusement rides." (A006380). He also examined photos of rides from a well-known roller-coaster website. (A006385). He said that many different rides share a similar overall design, and that the same or similar magnetic brakes are used in many different rides, with variations–such as the number of brakes and the exact location of magnet assemblies–that do not impact physical principles or operation of the brake. The similarities among rides and brakes allowed Hanlon "a high degree of certainty" in determining the components of each ride. (A006384-A006385). All his conclusions are based on the evidence he reviewed and cited. (A006389).

The district court's Report and Recommendation overstates the complexity of the claims, especially to a person of Hanlon's experience. Claim 3 of the '125 patent is straightforward. (A011029-A011030, citing claim 3). It requires structural components that Hanlon is fully qualified to easily find in the evidence he reviewed: a car, wheels on the car, a track with rails, a metal fin under the car, and opposed magnet assemblies with magnets, brackets and plates. The other limitations are positional requirements for some of the components so that they cooperate, for example, "underside," "between," "spaced," and "side by side", and a functional requirement that the magnets and fin brake the car. Hanlon stated:

> For most of the rides addressed in this report, I was able to apply all the elements of claim 3 of the ‘125 patent to the structures in the ride in a straightforward way for literal infringement.

(A006386).

For each element of each ride at issue, Hanlon cited the evidence supporting his straightforward opinions, for example saying that the basic structural components were depicted in the cited drawings and documents. (*See, e.g.,* A006389-A006393 (“Mr. Freeze” ‘125 patent), A006393-A006397 (“El Toro” ‘125 patent), and A006398-A006401 (“El Toro” ‘237 patent)). The defendants did not dispute that the structural elements are present on their literally infringing rides.

Claims 1 and 10 of the ‘237 patent claim an adjustable magnetic brake. The claims require basic structural components of a magnetic brake: a non-magnetic member that passes between parallel arrays of permanent magnets, and (in claim 1) support walls. The presence of these elements has not been disputed. Two additional requirements were disputed by the defendants and their expert, and addressed on summary judgment: claim 1 element (f) “apparatus for adjusting eddy current,” (A011157), and element (g) “linkages for enabling movement” (A011159). However, the court acknowledged that “arguably” the disputed elements (f) and (g) “have been addressed” in Hanlon’s report. (A011035).

The *Daubert* inquiry should have asked whether an engineer with Hanlon's qualifications can reliably determine the presence of infringing, physical components installed on the rides–cars, tracks, fins, magnets, etc.–from review of photos, drawings, documents, testimony, and the like. See *Schneider ex rel. Estate of Schneider v. Fried*, 320 F.3d 396, 406 (3d Cir. 2003) (reversing exclusion of doctor's opinion that was based on experience and literature review). The answer is clearly yes. Reading technical drawings is what engineers do every day. *Daubert* does not require an expert to teach the court how to do the same analysis and reach the same conclusions, which is what the court required. (A011036 at n. 78 and A011038). *Inline Connection Corp. v. AOL Time Warner Inc.*, 470 F. Supp. 2d 424, 432 (D. Del. 2007) ("Under *Daubert* and FRE 702, it is not the court's role to evaluate and determine facts underlying an expert's testimony.").

The court confused *Daubert* with unrelated and inapplicable summary judgment cases. (A011027 at n. 56-57 (citing *Daubert* cases), A011028 at n. 59 (citing summary judgment cases unrelated to *Daubert*)). Here, identifying the claimed components requires no scientific testing, statistical inferences, extrapolations of academic studies, or any of the other techniques that lead to *Daubert* challenges. There is no scientific test to determine that a car is a car, that a wheel is a wheel, or that a magnet is a magnet. Hanlon used his qualifications and experience to analyze the cited evidence and reach the stated conclusions. *Daubert* requires nothing more. *Schneider*, 320 F.3d at 406 ("we conclude that Dr. Semigran's experience renders his testimony reliable"); *Gallentine v. Estate of Stekervetz*, 273 F. Supp. 2d 538, 542 (D. Del. 2003).

The district court erred in relying on the defendants' "*ipse dixit*" argument. The court cited *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997), *Oddi v. Ford Motor Co.*, 234 F.3d 136, 145-46 (3d Cir. 2000), and *Heller v. Shaw Industries, Inc.*, 167 F.3d 146, 153 (3d Cir. 1999). (A011031-A011032, A011036, and A011038). In *General Electric*, the Supreme Court affirmed exclusion of experts who opined that PCBs caused the plaintiff's cancer, where the experts' conclusions were not a proper extrapolation from four epidemiological studies that did not state a link between PCBs and cancer. 522 U.S. at 144-45.

The Third Circuit's *General Electric* standard is that a court "must examine the expert's conclusions in order to determine whether they ***could*** reliably flow from the facts known to the expert and the methodology used." *Oddi*, 234 F.3d at 146 (quoting *Heller*, 167 F.3d at 153) (emphasis added). Here, conclusions about the presence or absence of all the claim elements could reliably flow from the extensive evidence cited by Hanlon. He relied on direct evidence about the rides at issue to reach conclusions about those rides. By excluding Hanlon's conclusions as "*ipse dixit*," the district court held that Hanlon could not use of his own qualifications and experience to draw conclusions from drawings, documents, photos and testimony about the rides at issue. That is error.

Hanlon's *Daubert* reliability is conclusively established by the first-listed reliability factor in *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 742 n. 8 (3d Cir. 1994): "whether a method consists of a testable hypothesis." *See also Calhoun v. Yamaha Motor Corp., U.S.A.*, 350 F.3d 316, 321 (3d Cir. 2003); *Schneider*, 320 F.3d at 405. Hanlon's conclusions are impossible to fake or fudge. Hanlon's conclusions are that readily identifiable, structural components are present on many different amusement rides spread throughout the United States. The defendants had unlimited access to their own infringing rides. There is an easy way to test whether each ride has the elements recited in the claims. Each of Hanlon's opinions can be verified or disproved by inspecting the ride itself, not to mention the other evidence relied on by Hanlon. (For plaintiffs, the cost of physical inspection of every ride was prohibitive, so Hanlon relies on the additional sources of evidence that he cites in his report.) The defendants own the rides, and have every possible incentive, along with the unlimited opportunity, to test the conclusions. The decisive fact under *Daubert* is that the conclusions can be tested, whether or not the defendants bothered to do so.

As to literal infringement of the '125 patent, the defendants could not dispute the truth of Hanlon's conclusions, because they are in fact true. The defendants' expert, Kirtley, identifies no missing elements for nine infringing rides (A003539, A003546, A003566, A003570-A003571, A003580, and A003583). He denies understanding infringement (destroying his own credibility), but acknowledges that Hanlon's evidence depicts the structures required, for example stating: "[redacted]" citing a drawing used by Hanlon, SF34779 [described at A006394], that shows all the components of the '125 patent claim 3. (A003571). The court denied the defendants' tardy motion to construe "between." (A000818-A000819). The defendants' motion on the "between" ground was denied in the Report and Recommendation because, even without Hanlon's report, there was evidence of infringement. (A011135-A011138). For another ride, Poltergeist, the defendants' expert asserted that there were no magnetic brakes at all, which only raised a material issue of fact. (A011141 and A003582). For the '237 patent, the defendants challenged only the two elements that have functional requirements. (A011156-A011159). *Daubert* reliability is satisfied because Hanlon's conclusions are testable, were actually tested, and are in fact true.

The district court erred by relying on summary judgment cases that have nothing to do with *Daubert* reliability or admissibility of expert testimony: *Intellectual Science and Technology, Inc. v. Sony Electronics, Inc.,* 589 F.3d 1179,

CONFIDENTIAL MATERIALS REDACTED

1183-85 (Fed. Cir. 2009); and *Arthur A. Collins, Inc. v. Northern Telecom Ltd.*, 216 F.3d 1042, 1047-48 (Fed. Cir. 2000). (A011028 at n. 59 and A011038 at n. 83). The court cited *Intellectual Science* for a non-existent admissibility requirement that the "expert must set fourth [sic] the factual foundation for his infringement opinion in sufficient detail for the court to be certain that features of the accused product would support a finding of infringement under the claim construction adopted by the court…" (A011028 (quoting *Intellectual Science,* 589 F.3d at 1183)). But that quoted sentence begins: "To satisfy the summary judgment standard…" *Intellectual Science*, 589 F.3d at 1183.

The court repeatedly took the jury's role by requiring Hanlon to demonstrate to the court's satisfaction how all the evidence proves infringement of all the elements of all the rides. (A011028, A011032-A011033, A011036, and A011038). That is not a standard for admissibility of expert testimony, and cannot be the basis for wholesale exclusion of Hanlon under Rule 702. *Inline Connection,* 470 F. Supp. 2d at 432.

Intellectual Science states that "an expert's unsupported conclusion on the ultimate issue of infringement will not alone create a genuine issue of material fact." 589 F.3d at 1184 (applying Sixth Circuit law, but citing *Arthur A. Collins,* 216 F.3d at 1046). First, the expert's testimony was actually considered, not excluded. Second, the disputed infringement question was whether the accused product had equivalent structure for a means-plus-function clause. *Id*. at 1184-85. The expert declaration identified an "IC-109 multiplexer" as the required "ITDM" means. *Id*. at 1185. However, the expert did not say enough to support the conclusion that the multiplexer was equivalent to the means, a special legal requirement. *Id*. Here, there is no means clause and Hanlon's conclusions are supported by other evidence.

In *Arthur A. Collins,* the plaintiff's expert declaration stated, without support, that "JNet is a TST switch," where the claim required a TST switch. 216 F.3d at 1046. That assertion required further support to survive summary judgment. *Id*. at 1046-47. The expert also applied his own, erroneous definition of the claimed TST switch, which made the statement legally insufficient. *Id*. at 1047. The case correctly notes that at trial, an expert normally need only say that a claim limitation is present, consistent with Fed. R. Evid. 705. *Id*. ("[S]uch testimony of an expert witness may be proper during trial when the opposing party can challenge the factual basis of the expert's opinion during cross-examination."). *Arthur A. Collins* addresses a fact pattern on summary judgment that is not present here. Hanlon is saying that a car (on the ride as shown by evidence) is literally a car (in the claim), a magnet (on the ride as shown by evidence) is literally a magnet (in the claim), and so on for every element of literal infringement. For the two disputed elements of the '237 patent, he gave further explanation of how the infringing brakes meet the claim language. (*See* A011035, citing the El Toro example).

2. Hanlon provided a reliable and relevant opinion on equivalents

The district court said Hanlon's report lacked required "particularized evidence" on the doctrine of equivalents. (A011036 at n. 78). The court overlooked Hanlon's specific testimony on the doctrine of equivalents, which "fits" under *Daubert*, and must be allowed. The court cited *AquaTex Industries, Inc. v. Techniche Solutions*, 479 F.3d 1320, 1328 (Fed. Cir. 2007), which says that a comparison must be of individual elements. *Id.* at 1329. Hanlon's explicit reliance on the doctrine of equivalents is fully disclosed and complies with *AquaTex*. (A006386-A006389). Hanlon provides an extensive analysis applicable to all the rides that do not literally infringe because their "magnet assemblies are attached to the vehicle underside and the fin assemblies are attached to the track." (A006387). The "fin" on those rides is not literally "extending from an underside" of a car. (A006388). Hanlon's report has a full explanation how the specific limitations, fins and magnet assemblies on those rides, meet the insubstantial-difference and function-way-result tests for the doctrine of equivalents. (A006386-A006389). See *AquaTex*, 479 F.3d at 1329 (discussing tests); *McKesson Automation, Inc. v. Swisslog Italia S.P.A.*, 712 F.Supp.2d 283, 297 (D. Del. 2010) (overruling *Daubert* objection where expert compared function, way, and result). The related summary judgment because "the court has struck Hanlon's expert report" also is in error. (A011134-A011135).

Oddi v. Ford Motor, 234 F.3d at 145-46 held that the standard of admissibility is not a high one, and that plaintiffs are not required to prove their case twice, once to the court and again to the jury. The plaintiffs need only show reliability by a preponderance of the evidence. They do not have to show that the report is even correct. Once reliability is shown, the rest belongs to a jury. *Id.*

VII. CONCLUSION AND STATEMENT OF RELIEF SOUGHT

There are factual issues regarding invalidity of the '125 patent. There are factual issues regarding infringement of both patents. Hanlon's report identifies where infringement is found, using the defendants' documents. His reasoning is rational, his analysis was provided as required, and he was qualified.

The plaintiffs request that the judgment be vacated, and this case remanded for a jury trial.

Dated: October 28, 2014

Respectfully submitted,

/s/ Joseph N. Hosteny, III

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PROOF OF SERVICE

The undersigned hereby certifies that on October 28, 2014 I caused the foregoing **NON-CONFIDENTIAL BRIEF OF PLAINTIFFS-APPELLANTS MAGNETAR TECHNOLOGIES CORP. AND G&T CONVEYOR CO.** to be electronically filed through the CM/ECF system, which will send a notice of electronic filing to counsel for all parties to the action who are registered in the CM/ECF system. Copies of the above-mention document have also been served by e-mail to the following:

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CERTIFICATE OF COMPLIANCE

The undersigned hereby certifies that this brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B). The brief contains 10,981 words (including 35 words or numerals in the two images), excluding the parts of the brief exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b).

This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared using Microsoft Word 2010 in Times New Roman, a proportionally spaced typeface, and 14-point size font.

Dated: October 28, 2014

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ADDENDUM

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ADDENDUM 1

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

MAGNETAR TECHNOLOGIES CORP., ET AL., :
Plaintiffs, :
v. : Civil Action No. 07-127-LPS
SIX FLAGS THEME PARKS, INC., ET AL., :
Defendants. :

MEMORANDUM ORDER

At Wilmington this **29th** day of **July, 2014**:

IT IS HEREBY ORDERED that:

1. The Reports and Recommendations issued by Chief Magistrate Judge Mary Pat Thynge (D.I. 404, 405, 407) ("Reports") are ADOPTED and Plaintiffs' objections to those Reports (D.I. 409, 410, 411) are OVERRULED.

2. Defendants' Motion to Exclude Plaintiffs' Infringement Expert, Mark T. Hanlon, (D.I. 343) is GRANTED.

3. Defendants' Motion to Exclude Plaintiffs' Lay Witness, Edward Pribonic, (D.I. 341) is GRANTED IN PART and DENIED IN PART.

4. Defendants' Motion for Summary Judgment of Invalidity of the '125 Patent (D.I. 337) is GRANTED.

5. Plaintiffs' Motion for Summary Judgment of Infringement of Claim 3 of the '125 Patent (D.I. 327) is GRANTED IN PART and DENIED IN PART.

6. Defendants' Motion for Summary Judgment of Non-Infringement of Claim 3 of

'125 Patent (D.I. 339) is GRANTED IN PART and DENIED IN PART.

7. Defendants' Motion of Invalidity and Non-Infringement of '237 Patent (D.I. 333) is DENIED as to invalidity and GRANTED as to non-infringement.

8. Plaintiffs' Motion for Summary Judgment of Infringement of '237 Patent (D.I. 329) is DENIED.

9. Judgment is entered FOR Defendants and AGAINST Plaintiffs. The Clerk of Court is directed to CLOSE this case.

LEGAL STANDARDS

A Magistrate Judge has authority to make a report and recommendation as to resolution of a case-dispositive motion, such as a motion for summary judgment. *See* 28 U.S.C. § 636(b)(1)(B); *Beazer E., Inc. v. Mead Corp.*, 412 F.3d 429, 444 (3d Cir. 2005). When reviewing the decision of a Magistrate Judge on a dispositive matter, the Court conducts a *de novo* review. *See* 28 U.S.C. § 636(b)(1); Fed. R. Civ. P. 72(b)(3). Because a motion for summary judgment is considered a dispositive matter, the conclusions of the Magistrate Judge in connection with such a motion are reviewed *de novo*. *See N.L.R.B. v. Frazier*, 966 F.2d 812, 817 (3d Cir. 1992). The Court may accept, reject, or modify the recommendations of the Magistrate Judge. *See* 28 U.S.C. § 636(b)(1); *Hill v. Beyer*, 62 F.3d 474, 481 (3d Cir. 1995). The Court may also receive further evidence or return the matter to the Magistrate Judge with instructions for further proceedings. *See* 28 U.S.C. § 636(b)(1).

In reviewing a recommendation regarding summary judgment, the Court applies the same standards as the Magistrate Judge. Accordingly, "[t]he court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). The moving party bears the burden of demonstrating the absence of a genuine issue of material fact. *See Adickes v. S. H. Kress & Co.*, 398 U.S. 144, 157 (1970). An assertion that a fact cannot be – or, alternatively, is – genuinely disputed must be supported either by citing to "particular parts of materials in the record, including depositions, documents, electronically stored information, affidavits or declarations, stipulations (including those made for the purposes of the motion only), admissions, interrogatory answers, or other materials," or by "showing that the materials cited do not establish the absence or presence of a genuine dispute, or that an adverse party cannot produce admissible evidence to support the fact." Fed. R. Civ. P. 56(c)(1)(A) & (B). If the moving party has carried its burden, the nonmovant must then "come forward with specific facts showing that there is a genuine issue for trial." *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587 (1986) (internal citation omitted). The Court will "draw all reasonable inferences in favor of the nonmoving party, and it may not make credibility determinations or weigh the evidence." *Reeves v. Sanderson Plumbing Prods., Inc.*, 530 U.S. 133, 150 (2000).

To defeat a motion for summary judgment, the non-moving party must "do more than simply show that there is some metaphysical doubt as to the material facts." *Matsushita*, 475 U.S. at 586; *see also Podobnik v. U.S. Postal Serv.*, 409 F.3d 584, 594 (3d Cir. 2005) (stating party opposing summary judgment "must present more than just bare assertions, conclusory allegations or suspicions to show the existence of a genuine issue") (internal citation omitted). However, the "mere existence of ***some*** alleged factual dispute between the parties will not defeat an otherwise properly supported motion for summary judgment;" and a factual dispute is genuine only where "the evidence is such that a reasonable jury could return a verdict for the nonmoving party." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 247-48 (1986) (emphasis in original). "If the evidence is merely colorable, or is not significantly probative, summary judgment may be granted." *Id.* at 249-50 (internal citations omitted); *see also Celotex Corp. v. Catrett*, 477 U.S. 317, 322 (1986) (stating entry of summary judgment is mandated "against a party who fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial"). Thus, the "mere existence of a scintilla of evidence" in support of the non-moving party's position is insufficient to defeat a motion for summary judgment; there must be "evidence on which the jury could reasonably find" for the non-moving party. *Anderson*, 477 U.S. at 252.

A *Daubert* motion to exclude testimony presents a non-dispositive matter, and objections to a Magistrate Judge's recommendation on a non-dispositive motion are subject to a "clearly erroneous and contrary to law" standard of review, pursuant to 28 U.S.C. § 636(b)(1)(A) and Fed. R. Civ. P. 72(a). Under a "clearly erroneous" standard, the appellate court will only set aside factual findings when it is "left with the definite and firm conviction that a mistake has been committed." *Green v. Fornario*, 486 F.3d 100, 104 (3d Cir. 2007) (citing *Concrete Pipe & Prods. of Cal., Inc. v. Constr. Laborers Pension Trust for S. Cal.*, 508 U.S. 602, 622 (1993)). Accordingly, it is "the responsibility of an appellate court to accept the ultimate factual determination of the fact-finder unless that determination either (1) is completely devoid of minimum evidentiary support displaying some hue of credibility, or (2) bears no rational relationship to the supportive evidentiary data." *Giles v. Kearney*, 571 F.3d 318, 322 (3d Cir. 2009). A Magistrate Judge's order is contrary to law "when the magistrate judge has misinterpreted or misapplied the applicable law." *Doe v. Hartford Life & Accident Ins. Co.*, 237

F.R.D. 545, 548 (D.N.J. 2006); *see also Eisai Co., Ltd. v. Teva Pharm. USA, Inc.*, 629 F. Supp. 2d 416, 424 (D.N.J. 2009) ("While a magistrate judge's decision typically is entitled to deference, a magistrate judge's legal conclusions on a non-dispositive motion will be reviewed de novo.") (internal citation omitted).

The Third Circuit has explained that it "afford[s] a district court's application and interpretation of Rule 702 plenary review," but "review[s] the [trial] court's decision to admit or reject testimony under an abuse of discretion standard." *Oddi v. Ford Motor Co.*, 234 F.3d 136, 146 (3d Cir. 2000). "The district court abuses its discretion if its decision rests upon a clearly erroneous finding of fact, an errant conclusion of law, or the improper application of law to fact." *Ragguette v. Premier Wines & Spirits*, 691 F.3d 315, 322 (3d Cir. 2012). An abuse of discretion can also occur when "no reasonable person would adopt the district court's view." *In re Cendant Corp. Prides Litig.*, 233 F.3d 188, 192 (3d Cir. 2000) (citing *Oddi*, 234 F.3d at 146).

DISCUSSION

The Court heard oral argument on Plaintiffs' objections on April 18, 2014. Given the parties' familiarity with this long-running case, the thorough and well-reasoned Reports of the Magistrate Judge (which together run to 118 pages), and the further input the Court received at the hearing, the Court here provides only limited comments with respect to the reasoning for its disposition of the various motions.

Motion to Exclude Hanlon

Plaintiffs assert that the Report applied incorrect legal standards in concluding that Hanlon's opinions were not reliable. (D.I. 409 at 1) Federal Rule of Civil Procedure 26(A)(2)(B)(i) requires that an expert report must contain a "complete statement of all opinions the witness will express and the basis and reasons for them." Hanlon's report fails to meet this standard, as it simply lists general references to multiple documents which purportedly show how each element of claim 3 of the '125 patent is satisfied. This leaves "too great an analytical gap between the data and the opinion being proferred." *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997).

Motion to Exclude Pribonic

Magistrate Judge Thynge recommended limiting the testimony of Plaintiffs' witness, Edward Pribonic, to just the relationship of Magnetar's brakes to claim 3 of the '125 patent. Judge Thynge further recommended excluding as irrelevant Pribonic's testimony relating to (1) the advantages of magnetic brakes over other types of brakes, (2) the importance of roller coasters to amusement parts, and (3) the importance of magnetic brakes in the construction of roller coasters. (D.I. 405) Plaintiffs object that a relevancy analysis is not a "pretrial matter" and that Pribonic's testimony should be allowed without restriction. (D.I. 410) Plaintiffs further argue that "to the extent the Report does address a 'pretrial matter' under Section 636(b), the Report requires de novo review." (*Id.* at 2)

The Court disagrees with Plaintiffs' argument that Judge Thynge lacked authority to deal with this issue. The Court referred all motions to Judge Thynge on September 28, 2012 (D.I. 323), a referral to which Plaintiffs did not object until ***after*** Judge Thynge issued her recommendations against them. Given Judge Thynge's familiarity with this case, it was entirely proper and efficient for the Court to refer all motions to her, including those requiring a determination of the relevancy of testimony. *See generally In re Japanese Elec. Prods.*, 723 F.2d 238, 260 (3d Cir. 1983) ("[W]e hold that the trial court has discretion to make even relevancy rulings pre-trial, subject to review for abuse of discretion."). Lastly, as the motion to exclude presents a non-dispositive matter, it will be reviewed for clear error.

Plaintiffs assert that Pribonic's "disputed testimony is directly related to the nature of the patented inventions" and "will provide insight into the value of the patented invention in the context of the hypothetical negotiation." (D.I. 410 at 1) However, the general categories on which Pribonic seeks to testify fail to establish a nexus between the patents-in-suit and magnetic brakes, roller coasters, or amusement parks generally. This testimony is irrelevant and will be excluded, consistent with Judge Thynge's Reports.

Summary Judgment of Invalidity of '125 Patent

Next, Plaintiffs object to Judge Thynge's recommendation that Defendants' motion for summary judgment of invalidity of claim 3 of the '125 patent be granted. Defendants assert four bases for invalidity: (1) the patent contains a clear error that renders it fatally indefinite; (2) the patent fails to name an inventor; (3) the subject matter of claim 3 was reduced to practice, offered for sale, and actually sold prior to the critical date, giving rise to an on-sale bar under 35 U.S.C. § 102(b); and (4) the claim is invalid as an obvious and predictable combination of known elements.

Reviewing the motion for summary judgment *de novo*, the Court agrees with Judge Thynge that Defendants are correct on all four grounds. A clear error in the patent claim renders it indefinite. The Court can correct such an error only if (i) the correction is not subject to reasonable debate based on consideration of the claim language and the specification, and (ii) the prosecution history does not suggest a different interpretation of the claims. *See Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1357 (Fed. Cir. 2003). The Court agrees with

Defendants that any of "said wheels," "said rails," or "said track" are plausible substitutions for the erroneous recital of "said tracks." However, it is also clear that this multiplicity of plausible substitutions leaves the scope of the claim subject to reasonable debate. As such, the Court cannot correct the error and claim 3 of the '125 patent is invalid.

"If nonjoinder of an actual inventor is proved by clear and convincing evidence, a patent is rendered invalid." *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1349 (Fed. Cir. 1998) (internal citations omitted). As Judge Thynge concluded, Mr. Kwangho Chung was an unnamed inventor, a conclusion which she properly derived from Mr. Chung's testimony that it was his idea to use the double-sided motor that is the subject of claim 3 of the '125 patent. (D.I. 407 at 11) This testimony about Mr. Chung's role in the invention is corroborated by the testimony of Mr. Joel Staehs, the only living named inventor of the '125 patent, who confirmed that this was, indeed, Mr. Chung's idea. (D.I. 407 at 12)

"[A]n accused infringer challenging the validity of a patent under the on-sale bar must demonstrate by clear and convincing evidence that there was a definite sale or offer to sell more than one year before the application for the subject patent, and that the subject matter of the sale or offer to sell fully anticipated the claimed invention or rendered it obvious." *Elan Corp., PLC v. Andrx Pharm., Inc.,* 366 F.3d 1336, 1340 (Fed Cir. 2004) (internal citations omitted). Plaintiffs have failed to show a genuine dispute of material fact to counter Defendants' evidence that a BAE system embodying the patented invention was offered for sale and sold prior to the critical date of October 28, 1991. While Plaintiffs assert that only design services were sold or offered for sale (D.I. 407 at 24), the Court's review of the evidence reveals that a reasonable finder of fact could only find that the Engineering Services Proposal was for a system that included the subject matter of claim 3. Prior to the critical date, United had purchased (and partially paid for) the engineering, manufacturing, and installation of the prototype invention. Therefore, the patent is invalid under 35 U.S.C. § 102(b).

Judge Thynge also concluded that a person of ordinary skill in the art would have found the combination of Miller's pinch brake and Demukai's double-sided magnetic brakes obvious. Plaintiffs' expert provided no opinion on whether the combination of existing elements was obvious. The Court agrees with Judge Thynge that claim 3 of the '125 patent is invalid as obvious in light of the prior art.

Summary Judgment of Infringement of Claim 3 of the '125 Patent
Summary Judgment of Non-Infringement of Claim 3 of '125 Patent

Both sides move for summary judgment with respect to infringement of the '125 patent and request that the Court address infringement even if (as has happened) the Court adopts Judge Thynge's conclusion that Defendants should be granted summary judgment of invalidity of claim 3 of the '125 patent. Plaintiffs assert that Defendants' interrogatory responses and expert report failed to put forth any facts to rebut Plaintiffs' infringement contentions, while Defendants counter that Plaintiffs never articulated specific infringement allegations, leaving Defendants no meaningful opportunity to respond.

Defendants' motion for summary judgement categorizes all accused rides as follows: (1) rides with opposed magnet assemblies mounted to the car, and fins mounted to the track structure; (2) rides with fins mounted to the car but magnet assemblies mounted above or below the rails rather than directly "between" the rails; and (3) rides with brake systems that do not include a fin and/or magnet assemblies at all. (D.I. 407 at 46) The Court concludes that, with respect to the first category of rides, Plaintiffs have failed to provide the particularized testimony required to support their claim of infringement under the doctrine of equivalents.[1] Additionally, the doctrine of equivalents cannot be used to vitiate a claim term, which would be the result if Plaintiffs' contentions were accepted. Regarding the second category of rides, the claim term "between" requires construction, and the Court agrees with Judge Thynge that there remains a genuine dispute of material fact as to infringement by these rides. As for the third category of rides, the Court agrees with Judge Thynge that there is no genuine dispute of material fact that certain accused rides (Vertical Velocity, V2) do not infringe (as they have linear synchronous motors mounted beneath the cars that propel the vehicles along the track and act as brakes) but there is such a dispute with respect to whether an additional accused ride, Poltergeist, infringes (e.g., whether it uses friction brakes).

Accordingly, as Judge Thynge recommended, both parties' motions for summary judgment relating to infringement of claim 3 of the '125 patent are granted in part and denied in part.

Summary Judgment of Invalidity and Non-Infringement of '237 Patent
Summary Judgment of Infringement of '237 Patent

Defendants did not object to Judge Thynge's recommendation that their motion for summary judgment of invalidity of the '237 patent be denied. For the reasons stated by Judge Thynge, Defendants are not entitled to summary judgment of invalidity due to lack of adequate written description or obviousness.

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[1]In determining whether to grant summary judgment of non-infringement, the Court will not consider the testimony of Hanlon it has stricken.

Both parties move for summary judgment with respect to infringement of the '237 patent. The Court agrees with Judge Thynge that Defendants should be granted summary judgment of non-infringement, while Plaintiffs' motion for summary judgment of infringement should be denied.

As Defendants show, in none of the accused rides is the braking force adjusted as a function of the velocity of the fin when it is between the arrays; rather, it is adjusted either to an off or on position (rather than being a "self-regulating" apparatus) based on a control system measurement taken upstream of the brake. (D.I. 407 at 71-72) As Defendants argue, "because the accused rides employ a sensor measuring the speed of the car upstream from the brake to determine whether the brake should be on or off, those rides cannot meet the requirement that the braking force is adjusted 'in a way that depends on velocity of the 'member' ***between the first and second 'arrays' of magnets***.'" (*Id.* at 72) (emphasis in original)

Plaintiffs contend that the location of measurement is irrelevant, since the measurement upstream will necessarily take into account the velocity of the member between the magnets. "If the measurement occurs upstream, the velocity between the arrays will either: 1) decrease, 2) increase, or 3) not change from the velocity at the upstream point. In any case, braking force will still be adjusted as a function [of] the velocity of the member between the array (i.e. the velocity at upstream measurement point plus or minus any change in velocity from measurement point to array)." (D.I. 365 at 4) "The operation of the accused brakes is functionally related to the velocity at the brake." (D.I. 411 at 22) But Plaintiffs' evidence – including Defendants' brake manuals (D.I. 365, Exs. 4, 7), deposition testimony (D.I. 365, Ex. E), and a contract for a wooden roller coaster which specifies the use of magnetic brakes (D.I. 330, Ex. K) – fails to provide a basis on which a factfinder could reasonably find that the accused brakes operate as required by asserted claims 1 and 10. The brake manuals explain that the eddy current is adjusted by pneumatic valves to induce braking force, but does not address any relationship between this braking force and the velocity of the member, either between the arrays or outside them. Similarly, the manuals state there is a change in the spacing of the arrays, but do not show this is a result of any movement of the member therepast, as required by claims 1 and 10. Chickola's deposition testimony sheds little light on the question of how the brakes are turned on or off, simply stating that they can be adjusted. And the contract for a wooden roller coaster – specifying that "[m]agnetic-type brakes will also be incorporated into the design to allow for smooth stops. Magnetic brakes will be used in the primary slowdown zone and in the station/maintenance area as speed regulators" (D.I. 330, Ex. K at 85) – gives no indication that the magnetic brakes being referred to are of a type that comes within the scope of claims 1 and 10 of the '237 patent.

UNITED STATES DISTRICT JUDGE

ADDENDUM 2

US005277125A

United States Patent [19]

DiFonso et al.

[11] Patent Number: 5,277,125

[45] Date of Patent: Jan. 11, 1994

[54] **MATERIAL HANDLING CAR AND TRACK ASSEMBLY HAVING OPPOSED MAGNET LINEAR MOTOR DRIVE AND OPPOSED PERMANENT MAGNET BRAKE ASSEMBLY**

[75] Inventors: **Gene DiFonso**, Arlington; **Joel L. Staehs**, DeSoto, both of Tex.

[73] Assignee: **BAE Automated Systems, Inc.**, Carrollton, Tex.

[21] Appl. No.: **967,661**

[22] Filed: **Oct. 28, 1992**

[51] **Int. Cl.**[5] **B60L 13/02**

[52] **U.S. Cl.** **104/292**; 104/294; 188/158; 188/267

[58] **Field of Search** 104/290, 292, 283, 294; 188/267, 158

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,613,805	9/1986	Matsuo et al.	318/687
4,848,242	7/1989	Matsuo	104/290
4,919,054	4/1990	Matsuo	104/94
5,018,928	5/1991	Hartlepp	414/339
5,127,599	7/1992	Veraart	104/292 X

FOREIGN PATENT DOCUMENTS

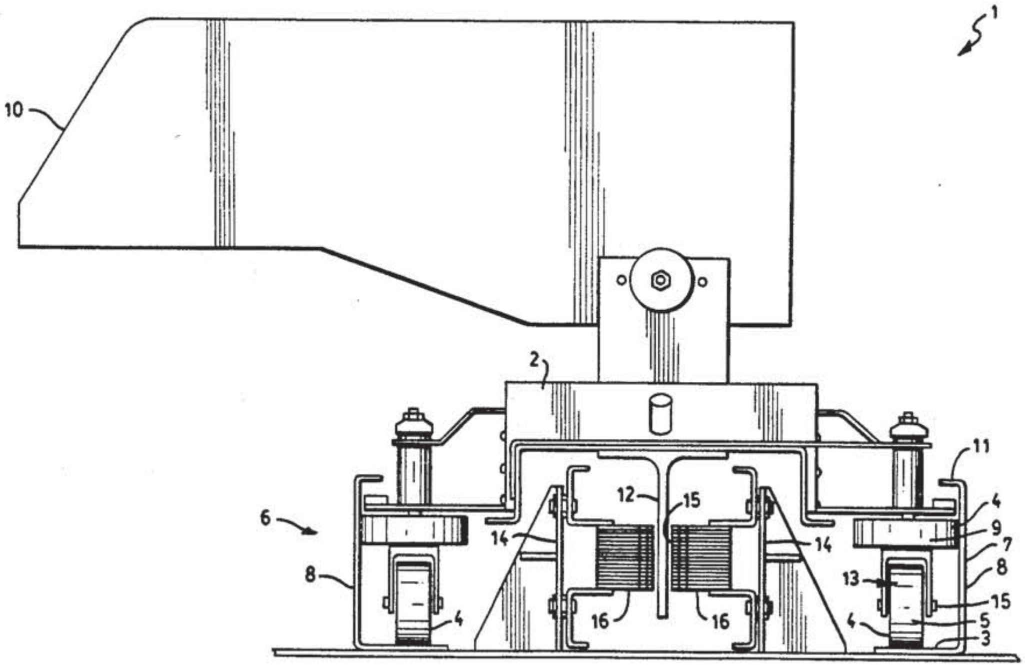
81105	4/1986	Japan	104/292
177101	8/1986	Japan	104/292
231804	10/1986	Japan	104/292

Primary Examiner—Robert J. Oberleitner
Assistant Examiner—S. Joseph Morano
Attorney, Agent, or Firm—Lorusso & Loud

[57] **ABSTRACT**

Material handling car and track assembly, the assembly comprising a car having wheels mounted thereon, and a track having two parallel rails, the wheels being adapted to roll on the rails to facilitate movement of the car along the track, a metal slider extending from an underside of the car and lengthwise of the car, and opposed linear motors mounted beween the tracks and spaced from each other to define a gap between the motors, the slider being daapted to pass through the gap, the motors being operative to act on the slider to impart thrust to the car, the motors being oriented such as to substantially eliminate magnetic atraction between the mtors and the car. The invention further contemplates opposied magents mountede beween the tracks and spaced from each other to define a gap between the magnets, the slider being dapted to pass through the gap between the magnets, the magnets being operative to act on the slider to impart braking to the car, whereby to decelerate the car.

3 Claims, 3 Drawing Sheets



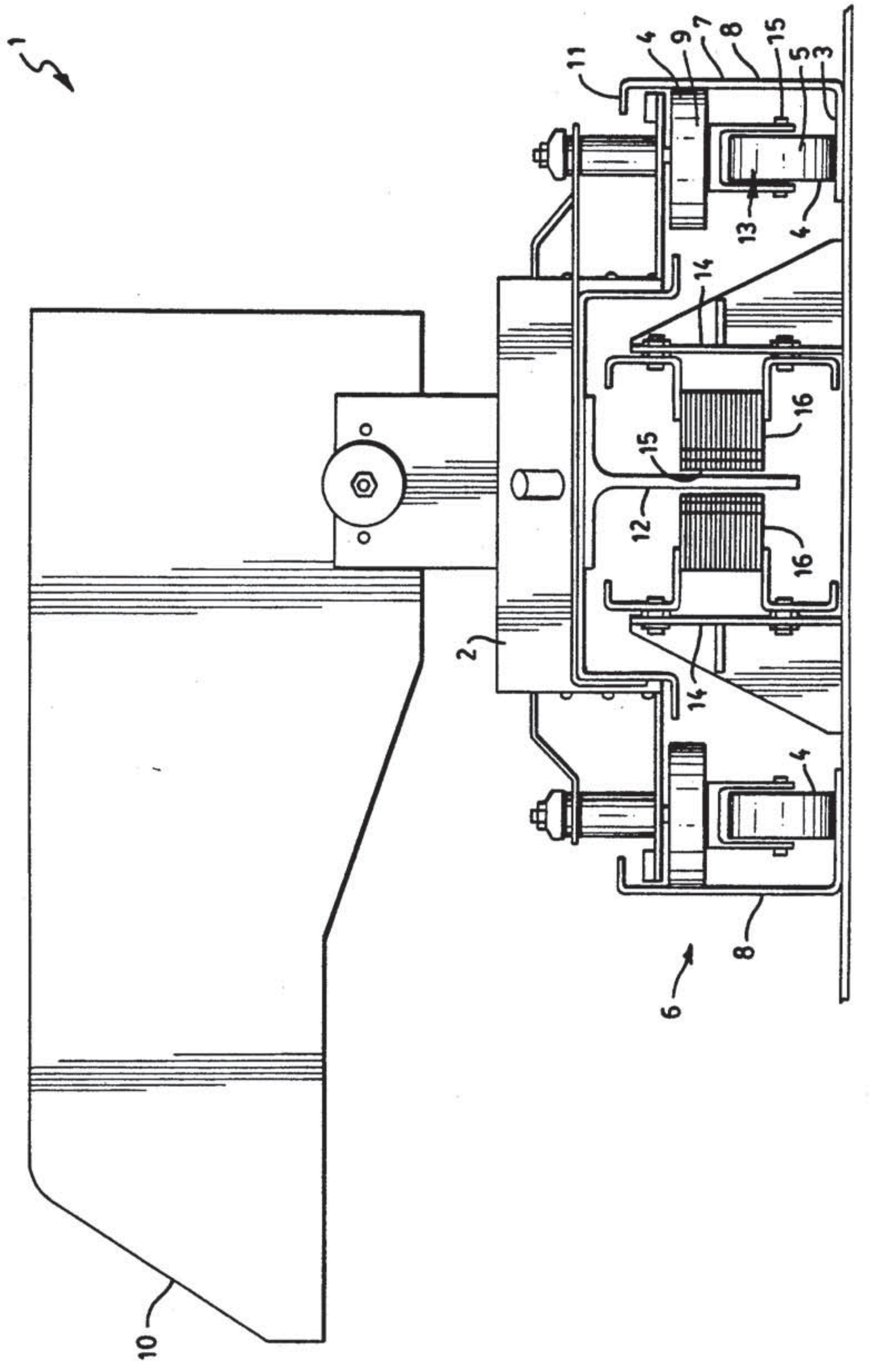

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FIG. 1

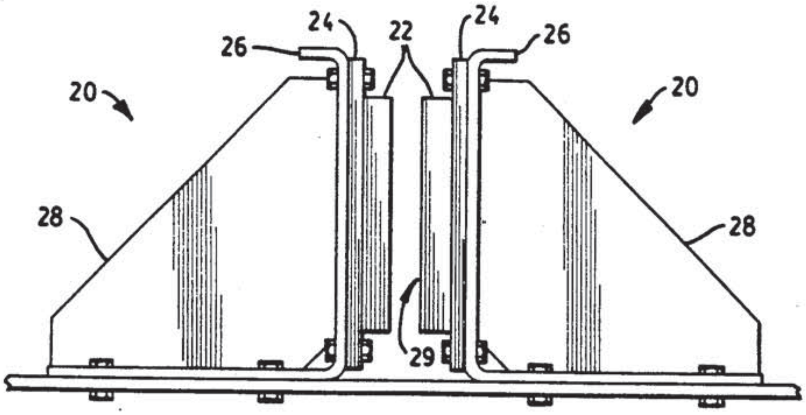
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FIG. 2A

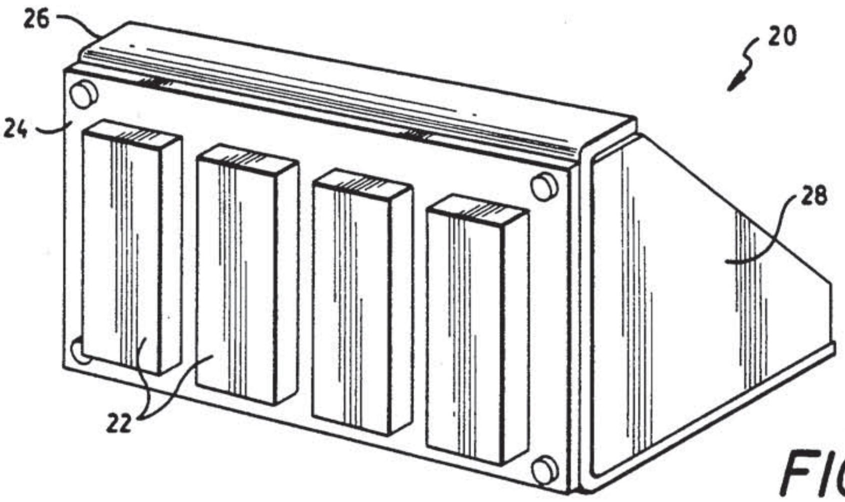
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FIG. 2B

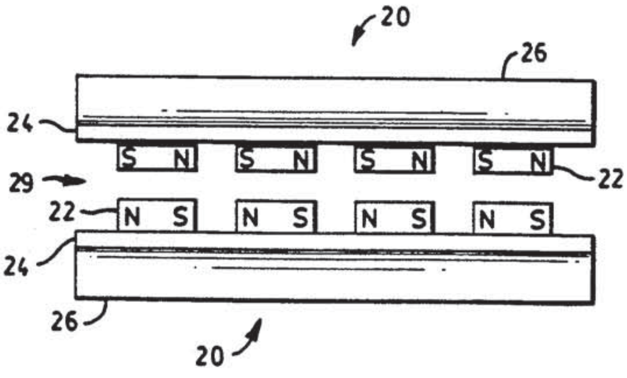
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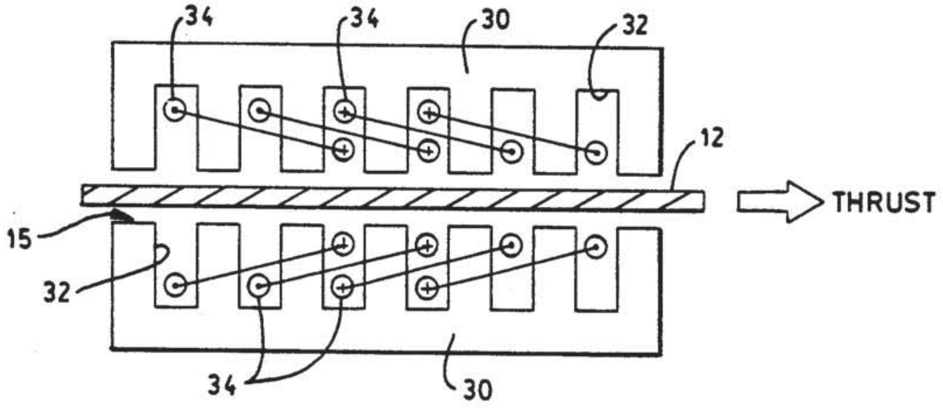
FIG. 2C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THRUST
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FIG. 3

MATERIAL HANDLING CAR AND TRACK ASSEMBLY HAVING OPPOSED MAGNET LINEAR MOTOR DRIVE AND OPPOSED PERMANENT MAGNET BRAKE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present fnvention relates to a material handling car and track assembly and is directed more particularly to acceleration and deceleration means mounted in the track assembly and adapted to influence speed of the car.

2. Description of Prior Art

The prior ar has recognized the need for means to propel a car along a track without the installation of a driver mechanism or braking mechanism on the car. Systems have incorporated linear induction motors as an efficient means of achieving this. Such systems commonly employ single motors along a track whereby a car is propelled by a force created by the change in magnetic flux as the car passes by the motors. However, a problem inherent in these systems is that of undue stress on the cars and tracks themselves due to an electromagnetic force created between the car and the motor, causing the car to be attracted toward the track. This attractive force exerted on the car dissipates after the car passes away from the motor. In systems where there are commonly several hundred motors in use through which a car passes as it travels through the system, the constant attractive stress and release of such stress, leads to wear and tear on the car. As a result, cars break down and are in need of frequent repair.

Such a system is disclosed in U.S. Pat. No. 4,919,054 to Matsuo. In this system, linear induction motors are disposed in single file underneath the transport path of the car, causing the motors to exert an attractive force while acting to drive the car. Due to numerous motors in the system, a car undergoing such repeated application and release of stress becomes structurally weak and requires frequent servicing.

Another problem recognized in the prior art relates to providing a means for controlling the speed of a car through the use of a decelerating mechanism external of the car. Many systems which have employed inductive motors to impel a car forward along a track have relied entirely upon the same motors for braking the car. A reverse thrust is applied to the car by passing reverse phase alternating current through the coils of the motor stators, to slow the car down. However, these systems potentially overwork the motors which often leads to motor failure.

An example of this type of system is disclosed in U.S. Pat. No. 4,848,242 to Matsuo. As in the Matsuo '054 system, single motors are disposed at predetermined intervals underneath the transport path and, as in the previous system, an attractive force on the car is exerted and released as the car moves in the direction of the transport path. The motors impel the car in the forward and reverse directions. Thus, the motors carry out the function of starting and stopping the car, depending on the direction of current flow. However, this dual function leads to increased wear and tear on the motors.

In other systems, such as disclosed in U.S. Pat. No. 5,018,928 to Hartlepp, a car is decelerated through the use of a magnetic piston which moves by compressed air in a tube, such that a car will follow the piston. However, the use of such a structure is complicated and

thus provides great opportunity for malfunction. Additionally, this system discloses the use of linear induction motors for propelling a car on a track wherein induction motors are singly disposed. Accordingly, an attractive force is exerted on the cars driven by the motor.

An additional problem recognized in the art is the need to mitigate the effects of motor failure. In U.S. Pat. No. 4,613,805 to Matsuo, there is disclosed a system providing for continued operation through the use of an auxiliary power source in the event that the main power source becomes disabled. However, this system does not insure continued operation in the event that a motor along the transport path should become disabled.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide a material handling car and track assembly which reduces wear and tear on cars traveling through the system and provides for continued operation in the event that a motor, or several motors, in the system become disabled. This object is accomplished by provision of a car having a metal slider on the underside of the car. The assembly further includes a track having two parallel rails. Movement is imparted to a car traveling on the rails by opposed linear motors operatively acting on the slider. The configuration of the motors is such that it causes the magnetic attraction between the linear motors and the car to substantially cancel out, thereby eliminating the attractive force on the car. Thus the cars, no longer subject to application and release of stresses, require less reparative maintenance and enjoy longer operating life. Additionally, through the use of coupled motors, should one motor become disabled, the remaining motor continues to impart motion until the afflicted motor is again operative.

A further object of the invention is to provide a simple means for decelerating the car without the use of mechanisms disposed on the car. The use of magnets disposed along the track enables the car's traveling speed to be decreased, the magnets operatively acting on the slider to decelerate the car.

With the above and other objects in view, as will herein after appear, a feature of the present invention is the provision of a material handling car and track assembly, the assembly comprising a car having wheels mounted thereon, and a track having two parallel rails, the wheels being adapted to roll on the rails to facilitate movement of the car along the track, a metal slider extending from an underside of the car and lengthwise of the car, and opposed linear motors mounted between the tracks, the motors being spaced from each other by a distance exceeding the thickness of the slider to define a gap between the motors, the slider being adapted to pass through the gap in travel of the car over the motors, the motors being operative to act on the slider to impart thrust to the car, the motors being oriented such as to substantially eliminate magnetic attraction between the motors and the car.

In accordance with a further feature of the invention, there is provided a material handling car and track assembly, the assembly comprising a car having wheels mounted thereon, and a track having two parallel rails, the wheels being adapted to roll on the rails to facilitate movement of the car along the track, a metal slider extending from an underside of the car and lengthwise of the car, and exposed magnets mounted between the tracks, the magnets being spaced from each other by a distance exceeding the thickness of the slider to define a gap between the magnets, the slider being adapted to pass through the gap in travel of the car over the magnets, the magnets being operative to act on the slider to impart braking to the car, whereby the magnets are operative to decelerate the car.

The above and other features of the invention, including various novel details of construction and combinations of parts, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular devices embodying the invention are shown by way of illustration only and not as limitations of the invention. The principles and features of this invention may be employed in various and numerous embodiments without departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made to the accompanying drawings in which are shown illustrative embodiments of the invention, from which its novel features and advantages will be apparent.

In the accompanying drawings:

FIG. **1** is a front elevational view of one form of material handling car and track assembly illustrative of an embodiment of the invention, wherein the material handling car is shown having a metal slider on an underside portion of the car, and the track assembly is shown with linear induction motors in opposition, forming a gap therebetween to accommodate the passage of the slider;

FIG. **2A** is a front elevational view of a decelerating means featuring decelerating magnets arranged in opposition and forming a gap therebetween adapted to accommodate the passage of the slider;

FIG. **2B** is a perspective view of a portion of the decelerating means of FIG. **2A**;

FIG. **2C** is a top view of a portion of the decelerating means of FIG. **2A**, showing the polar arrangement of magnets therein; and

FIG. **3** is a diagrammatic view of two opposed linear motors.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, it will be seen that the illustrative assembly includes a car **1** having a chassis **2** on which are mounted travel wheels **4** to facilitate movement along a track assembly **6**, which comprises two parallel rails **8**.

Each of the rails **8** is of a U-shaped configuration and, as shown in FIG. **1**, are opposed to each otherl Each of the U-shaped rails includes a substnatially horizontal bottom plae **3**, for supporting a vertical travel wheel **5** of the car **1**, and a substnatially ertical wall **7** for engagin a horizonal tavel wheel **9** of car **1**, and a top wall **11** overlyin the bottom plate **3** and extending iwnardly from eside wall **7**. Mounted on the chassis **2** is a tiltable tray **10** which is sized to accommodate a selected cargo, such as, for example, heavy, large or cumbersome baggage. The tray **10** is capable of being positioned in three positions, one in which it is adapted to receive material from a loading station, another in which it permits transport of material around curves in the track without spillage of material, and lastly, a third position in which it facilitates sliding of the material off the tray **10** onto a receiving platform.

On the underside of the chassis **2**, a slider **12** is mounted which runs lengthwise along the chassis **2**. The slider **12** comprises a fin which is preferably fabricated of an all-conductor, such as aluminum or copper. Other all-conductive materials are within the scope of the preferable materials, provided that such materials are non-magnetic. The use of such materials reduces the overall weight of the car so that it is 25% to 30% less than existing prior art cars which do not employ such materials. The slider **12** is preferably 0.25 inch thick and in one embodiment is **48** inches long.

Also shown in FIG. **1** is a track assembly with linear induction motors **16** disposed in opposition. Brackets **14** are disposed inwardly of the rails **8**, and are adapted to retain the linear induction motors **16** such that the motors **16** form a gap **15** sized to be greater than the width of the slider **12**. The two brackets **14** each hold a linear induction motor **16** in such an orientation that the motors extend to form the narrow gap **15** therebetween.

The linear induction motors **16** each include a stator assembly **30** (FIG. **3**) having slots **32** therein. Within each stator assembly **30**, there are disposed multiple phase windings **34**. The windings **34** are disposed in the slots **32** so as to form a distributed winding pattern. When excited by a multiple phase alternating current source (not shown), the windings **34** generate a traveling magnetic wave defined by

$$b = B \cos \frac{(\pi S)}{p}$$

where

B=peak value of magnetic flux density in air gap

S=lengthwise distance of stator gap

p=pole pitch of stator

Inasmuch as the conductive slider **12** consists entirely of non-magnetic material, no force is produced tending to pull the slider sideways.

Because of magnetic induction action between the air gap magnetic flux wave and the slider, there occurs a flow of eddy currents defined by

$$j = J \sin \frac{(\pi S)}{p}$$

where

J=peak value of eddy current flow in the slider.

Interaction between the air gap flux wave and resulting eddy currents induced on the slider, produces thrust in the direction orthogonal to both flux and eddy current waves. The coil polarities are reversed from one stator assembly to the opposing stator assembly across the gap **15**. As a result of this configuration, the attractive force created by single non-opposed stators is eliminated.

Referring to FIG. **1**, it will be seen th the motors **16** are on about the same level above the botom plates **3** as are the horizontal travel wheels **9** and portions **13** of the ertical travel wheels **5** above their axes **15**, when h car passes over the motors. Thus, as is paparent from FIG. **1**, the driving force imparted to the slider **12** by the motors **16** is on about the same level as the horizontal wheels and the portion of the vertical wheels above the vertical wheel axes. Thus, there is produced subsntially only a forward thrust, without a turning moment imparted to the travel wheels tending to lift the wheels off the track.

In operation, the motors may be run continuously or may be provided with selective turn-off switches, such that one or more groups of motors may be turned off during periods of inactivity. Alternatively, a "presence control" may be utilized wherein the approach of a car is sensed and the motors turned on and, as the departure of the car from the scene is sensed, the motors turned off. A second alternative comprises a "speed control" wherein the speed of an approaching car is sensed and the motors are activated or deactivated in accordance with a preset desired speed for the car.

In FIG. 2A, there are shown decelerating magnetic members **20**. Individual magnets **22** are each bonded to a steel plate **24** for support. The steel plates **24** are each attached to a mounting bracket **26**. Steel gussets **28** (FIGS. **2A** and **2B**), each about 0.25 inch thick, are mounted across an inner angle of the mounting brackets **26**, to provide support for the brackets **26**. The magnetic members **20** are positioned between the rails **8** so as to form a gap **29**, the width of which is greater than the width of the slider **12**.

FIG. **2B** shows the inner face of one of the identical opposed magnets and the positioning of the individual magnets **22**. A selected number of magnets, depending upon the weight and desired velocity of the vehicle, are placed on each of the steel plates **24**. FIG. **2C** shows the magnets **22** and the polar orientation thereof. Thus, when the slider **12** passes between the magnetic members **20**, as the car **1** travels along the tracks, the magnetic field created by the opposed polar orientation of individual magnets **22**, serves to decelerate the car **1**.

On the track assembly, the magnetic members **20** and the induction motors **16** are disposed in certain places where it is desirable that the speed of the car be either slowed or maintained. For example, in areas of an incline where it is likely that car speed will decrease, the induction motors may be disposed to maintain an appropriate speed. There are places along the track assembly where it is desirable that the speed of the car be decreased, such as in areas of sharp turns. It is in such areas that the magnetic members may be disposed to slow the car. Additionally, in areas where baggage is to be loaded onto and off of the tray of the car, magnetic members are disposed. Also, in areas where the tray has finished loading or unloading of baggage, induction motors may be positioned, so as to move the car along the track system and return the car to travel speed.

The motors may be reversed by merely reversing the direction of the traveling magnetic wave. This is accomplished by changing the phase rotation of the multiple phase power source, to provide a braking force on the cars. While it is preferable not to rely wholly on the motors for routine braking, use of the motors for braking over and beyond that provided by the magnetic members **20** is available.

It should be understood that the invention is not limited to the specific embodiment or construction described above and that various changes and modifications will be obvious to one skilled in the art without departing from the true spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A track assembly for driving a material handling car, said asembly comprisin:

two parallel rails upon which said car is driven, each of said rails havign a U-shaped configuration, said rails being in opposed position, each of said rails having a subsntaially horizontal bottom plate for

supporting a vertical travel wheel of said car, a substantially vertical side all for engaging a horizonal travel wheel of said car, and a top wall overlying said bottom plate and extending iwnardly from said side wall

linear induction motors mounted between said rails in an opposed configguration, said motors being on about the same level above said rail bottomplates as said horizontal travel wheel and portions of said vertical tarvel wheels above the axes thereof when said car passes over said motors, said opposed configuration defining a gap beween said motors permiting passage of a slider portion of said car therebetween, said configuration creating a driving force for impellin said car along said rails while causing cancellation of atractive forces exerted by seach of said induction motors respectively, such that said slider upon passage through said gap is subject only to said driving forcek said driving force being exerted by said motors at said level above said rail bottom plates so as to provide said driving force at said level of said horizontal travel wheels and said portions of said vertical travel wheels above said axes thereof, and

permanent magnets mounted between said rails at a point removed from said motors, said magnets being mounted in an opposed configuration defining a gap between said magnets which permits the passage of said slider therbetween, said magnets being adapted to exercise a braking force on said slider to decrease the speed of said car upon passage of said slider therebetween.

2. A material handling car and track assembly, said assembly comprising

a car having wheels mounted thereon, and a track having two parallel rails, said wheel being adapted to rolll on said rails to faciliate movement of said car along said track, a metal fin extending from an underside of said car and lengthwise of said car, said fin exending from said car between said wheels and

opposed linear motors mounted between said tracks, said motors being spaced from each other by a distance exceeding the thickness of said fin to define a gap between said motors, said fin being adapted to pass through said gap in travel of said car over said motors said motors being oriented such as to substanatially eliminate magentic attraction between said motors and said car, and said motors bieng disposed between said wheels when said car passes over said motors, said moors being disposed at a level above bottom plates of said track rails and genraly equal to the level of portions of said wheels above said bottom plates and above the axes of said wheels when said car passes over said motors, and

opposed permanent mgents mounted between said tracks at a point removed from said motors, said magnets being spaced from each other by a distance exceedig the thickness of said fin to define a gap between said magnets, said fin being adapted to pass through said gap between said magnets in travel of said car over said magnets, said magnets being disposed on plates mounted between said tracks, said magnets being mounted side by side in a direction of travel of said car, said magnets being operative sequentially to act on said fin to impart braking to said car, whereby said motors are operative to accelerate said car and said magnets are operative to decelerate said car.

3. Material handling car and track assembly, said assembly comprising:

a car having wheels mounted thereon, and

a track having two parallel rails, said wheel being adapted to roll on said rails to facilitate movement of said car along said track,

a metal fin extending from an underside of said car and lengthwise of said car, and

opposed magnet assemblies mounted between said tracks, said opposed assemblies being spaced from each other by a distance exceeding the thickness of said fin to define a gap between said magnet asemblies, said fin being adapted to pass through said gap in travel of said car over said magnets, each of said assemble is comprising a mounting bracket, a plate attached to said mounting bracket, and a series of magnets bonded to said plate, said magnets on said plate being disposed side by side in a direction of travel of said car on said rails, said magnets being operative sequentially to act on said fin to impart braking to said car.

* * * * *

ADDENDUM 3

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,277,125 Page 1 of 2

DATED : January 11, 1994

INVENTOR(S) : Gene DiFonso, Joel L. Staehs

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

In the Abstract:

Line 9: "daapted" should read "adapted"
Line 13: "mtors" should read "motors"
Line 14: "opposied" should read "opposed"
"magents" should read "magnets"
"mountede" should read "mounted"
Line 16: "dapted" should read "adapted"

Column 1: line 9; "fnvention" should read "invention"
Column 1: line 15; "ar" should read "art"

Column 3: line 53; "l" should read "."
line 54; "substnatially" should read —substantially—
line 55; "plae" should read —plate—
line 56; "substantially ertical" should read —substantially vertical"
line 56; "engagin" should read "engaging"
line 57; "tavel" should read "travel"
line 58; "overlyin" should read "overlying"
line 59; "eside" should read "the side"
Column 4: line 11; "48" should not be in bold
line 57; "th" should read "that"
line 58; "botom" should read "bottom"
line 60; "ertical" should read "vertical"
line 60; "h" should read "the"
line 61; "paperent" should read "apparent"
line 65; "substntially" should read "substantially"
Column 5: line 64; "asembly comprisin" should read "assembly comprising"
line 66; "havign" should read "having"
line 68; "substntaially" should read "substantially"

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,277,125 **Page 2 of 2**

DATED : January 11, 1994

INVENTOR(S) : Gene DiFonso, Joel L. Staehs

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 6: line 2; "all" should read "wall"
line 4; "iwnardly" should read "inwardly"
line 5; after "wall" please insert ","
line 7; "configguarion" should read "configeration"
line 10; "tarvel" should read "travel"
line 15; "impellin" should read "impelling"
line 16; "atractive" should read "attractive"
line 17; "seach" should read "each"
line 19; "forcek" should read "force"
line 29; "therbetween" should read "therebetween"

line 37; "rolll" should read "roll"
line 40; "exending" should read "extending"
line 47; after "said motors" please insert a comma ","
line 48; "substanatially" should read "substantially"
line 50; "bieng" should read "being"
line 53; "genraly" should read "generally"
line 57; "mgents" should read "magnets"
line 60; "exceedig" should read "exceeding"
Column 7: line 6; "wheel" should read "wheels"
Cloumn 8: line 2; "asem-" should read "assem-"

Signed and Sealed this

Eleventh Day of April, 1995

Attest:

BRUCE LEHMAN

Attesting Officer *Commissioner of Patents and Trademarks*

ADDENDUM 4

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,277,125 Page 1 of 1
APPLICATION NO. : 07/967661
DATED : January 11, 1994
INVENTOR(S) : DiFonso et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page: Item (75), Inventors, "Gene DiFonso, Arlington; Joel L. Staehs, DeSoto, both of Tex." should read -- Gene DiFonso, Arlington; Joel L. Staehs, DeSoto; William C. Bortzfield *(deceased)*, Grand Prairie, all of Tex.--.

In the claims column 8, line 6, "assemble is" should read -- assemblies --.

Signed and Sealed this

Tenth Day of April, 2007

JON W. DUDAS
Director of the United States Patent and Trademark Office

ADDENDUM 5

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,277,125 Page 1 of 1
APPLICATION NO. : 07/967661
DATED : January 11, 1994
INVENTOR(S) : DiFonso et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page: Item (75), Inventors, "Gene DiFonso, Arlington; Joel L. Staehs, DeSoto, both of Tex." should read -- Gene DiFonso, Arlington; Joel L. Staehs, DeSoto; Willaim C. Bortzfield (*deceased*), Grand Prairie, all of Tex.--.

Column 8, line 6, "assemble is" should read -- assemblies --.

Signed and Sealed this

Seventeenth Day of April, 2007

JON W. DUDAS
Director of the United States Patent and Trademark Office

ADDENDUM 6

US006659237B1

(12) **United States Patent**
Pribonic

(10) **Patent No.:** **US 6,659,237 B1**
(45) **Date of Patent:** **Dec. 9, 2003**

(54) **EDDY CURRENT BRAKE**

(75) Inventor: **Edward M. Pribonic**, Seal Beach, CA (US)

(73) Assignee: **Magnetar Technologies, Ltd.**, Seal Beach, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 53 days.

(21) Appl. No.: **09/880,353**

(22) Filed: **Jun. 13, 2001**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/447,206, filed on Nov. 22, 1999.

(51) **Int. Cl.**[7] **B60L 7/28**
(52) **U.S. Cl.** **188/165**; 108/180
(58) **Field of Search** 188/159, 161, 188/164, 165, 180, 41, 84; 104/250

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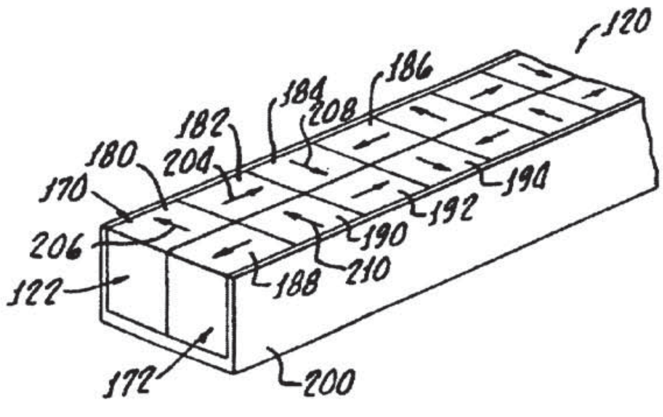
Primary Examiner—Jack Lavinder
Assistant Examiner—Bradley King
(74) *Attorney, Agent, or Firm*—Walter A. Hackler

(57) **ABSTRACT**

An eddy current brake includes a diamagnetic member, a first support wall and a second support wall with the first and second linear arrays of permanent magnets disposed on the walls facing one another. Apparatus is provided for moving at least one of the walls in order to control eddy current induced in the member in the passage of the member therepast to adjust the braking force between the magnets and the member. Apparatus is also provided for causing the velocity of the member to change the braking force between the magnets and the member.

10 Claims, 4 Drawing Sheets



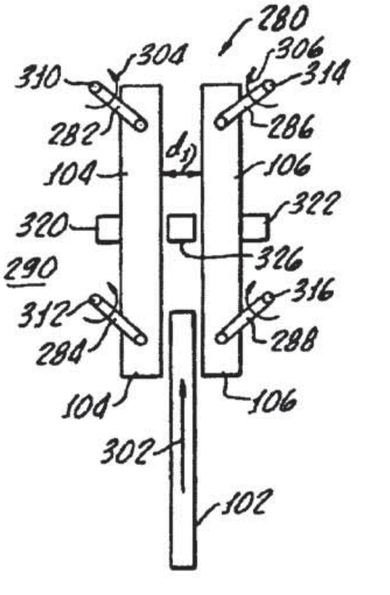
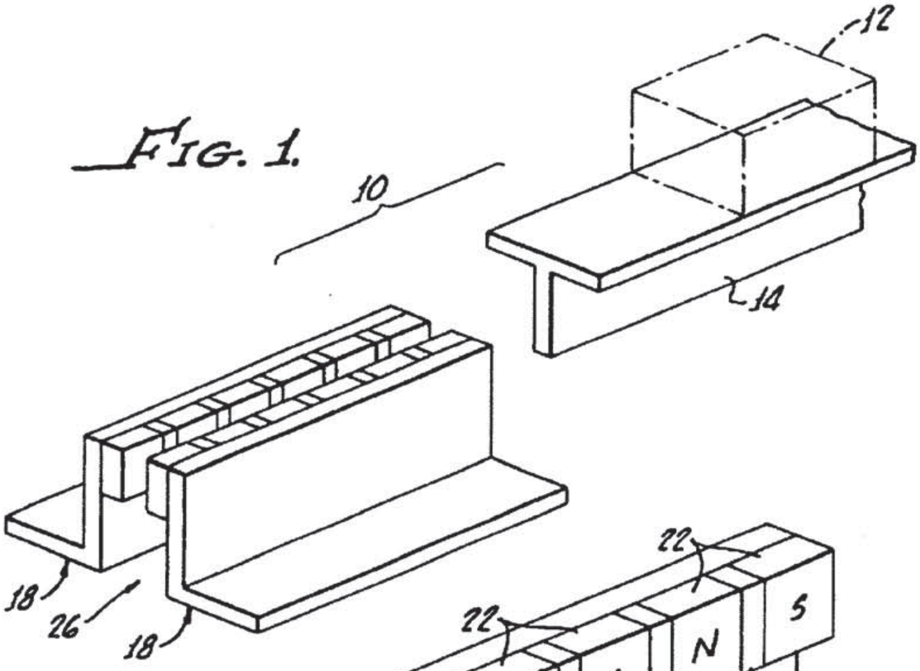


FIG. 1.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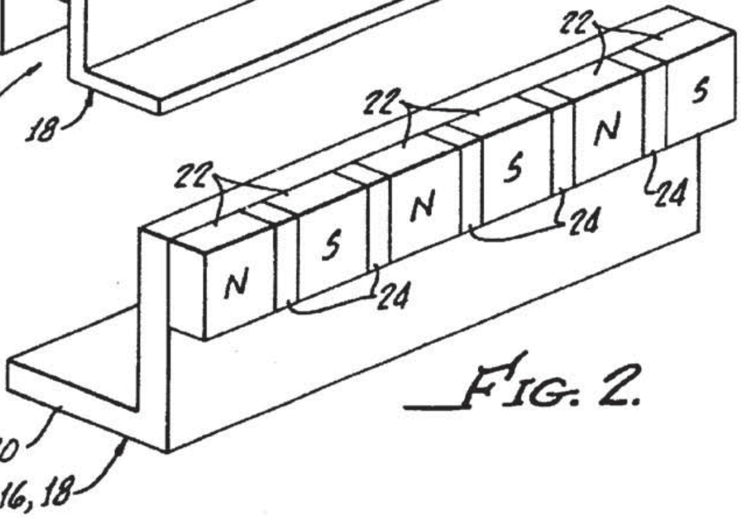
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16, 18

FIG. 2.

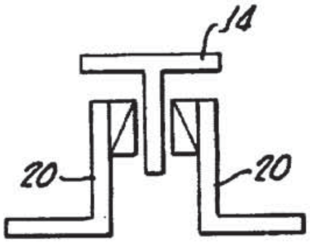

FIG. 3.

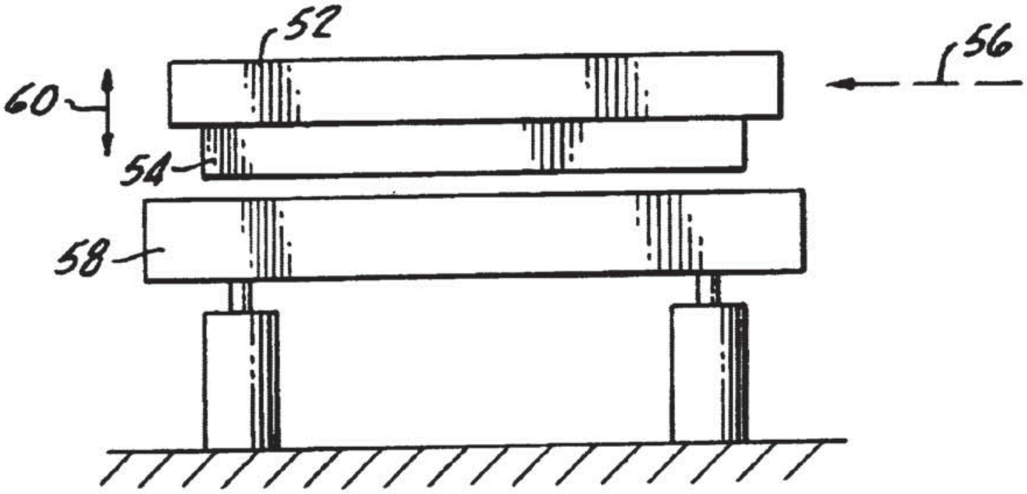
52
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FIG. 4.

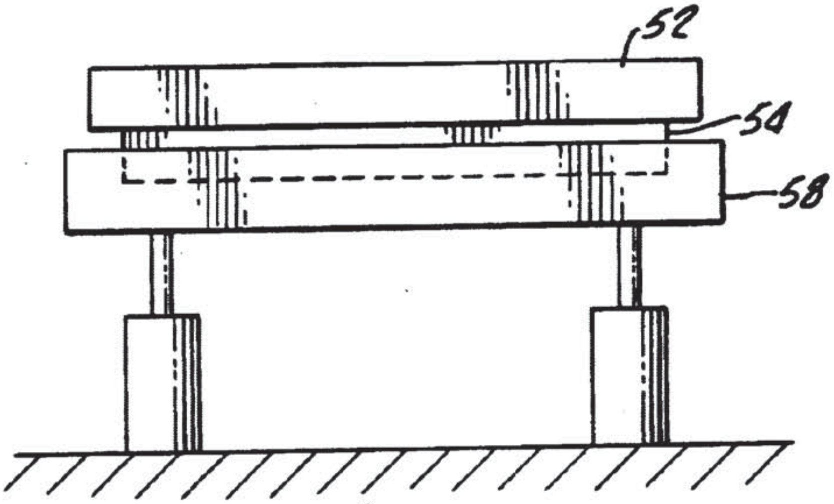
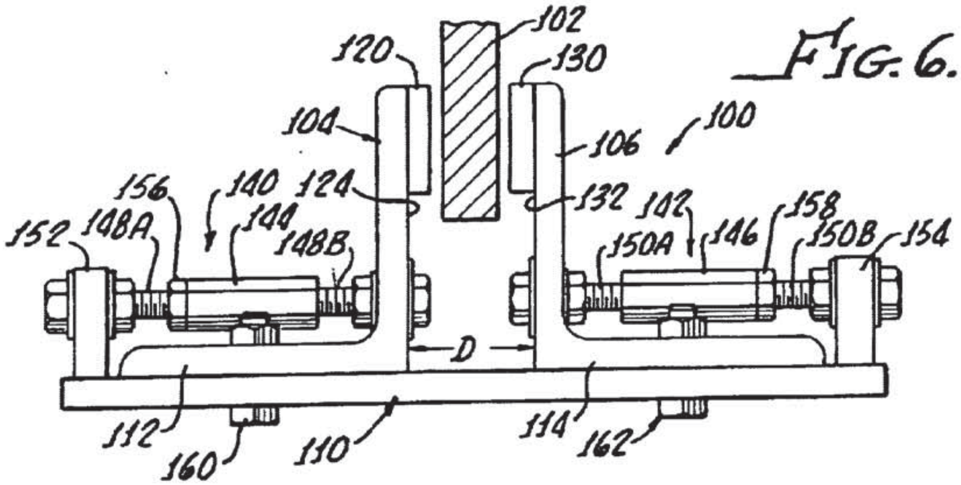


FIG. 5.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120
130
104
106
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156
140
124
132
142
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152
148A
144
148B
150A
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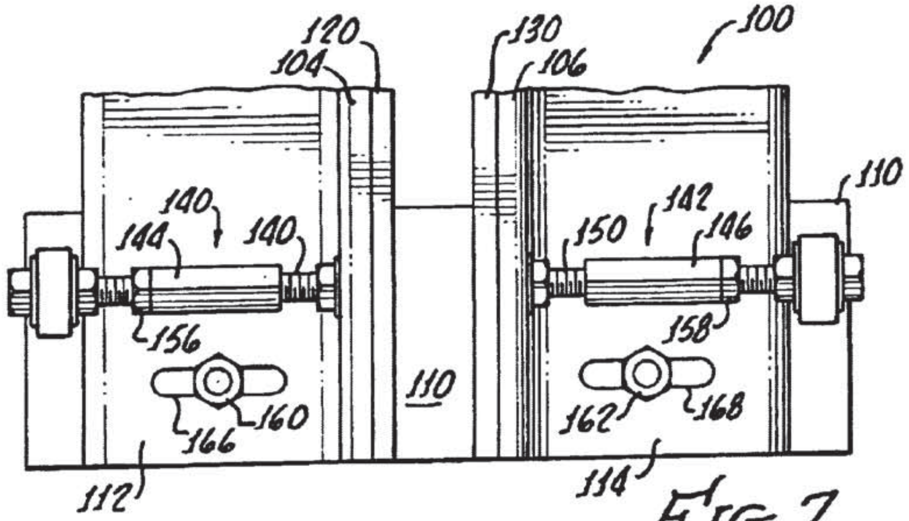
154
D
112
110
114
160
162

FIG. 6.


120
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100
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112
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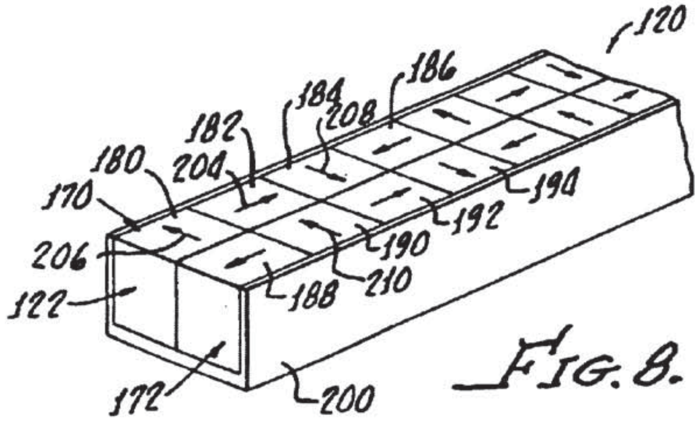
FIG. 7.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186
184
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182
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170
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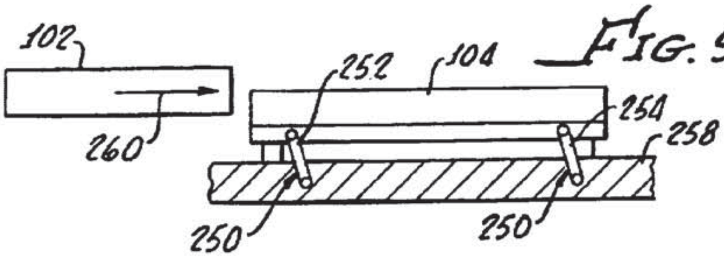
122
188
172
200

FIG. 8.


102
252
104
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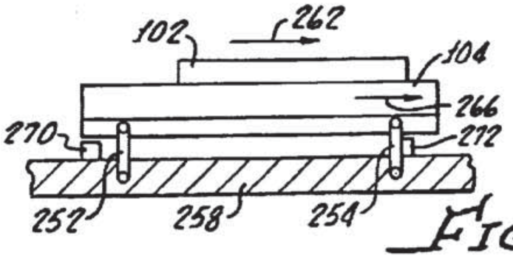
258
260
250
250

FIG. 9.


102
262
104
266
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252
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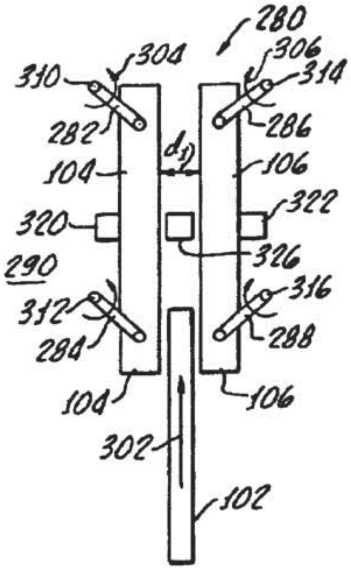
FIG. 10.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314
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d_1
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106
320
322
326
290
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316
284
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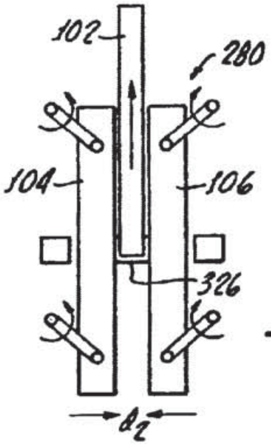
104
106
302
102

FIG. 11.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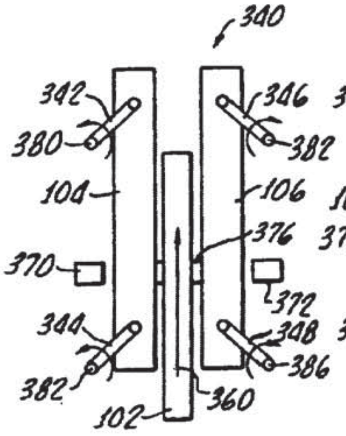
104
106
326
d_2

FIG. 12.


340
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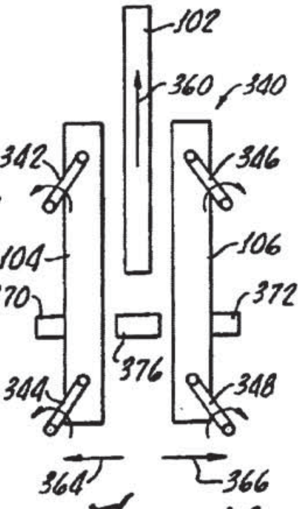
386
102
360

FIG. 13.


102
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366

FIG. 14.

EDDY CURRENT BRAKE

The present application, is a continuation-in-part of U.S. patent application Ser. No. 09/447,206 filed Nov. 22, 1999.

The present invention is generally related to permanent magnet linear brakes and is more particularly directed to an eddy current brake and magnet system for providing adjustable braking for movable cars, for example, rail support cars, go cars, elevator cars, conveyer car, roller coaster cars among other.

Heretofore, eddy current braking system for providing deceleration of moving apparatus have utilized physically fixed magnets which provided no opportunity to adjust braking before or during passage of a diamagnetic member past a linear array of permanent magnets.

Accordingly, such prior art systems, when installed for decelerating a plurality of cars on a track, can not accommodate for variations in car weight and size.

The present invention provides for a unique permanent array arrangement and apparatus for adjusting braking force before and/or during passage of a car past a selected point.

SUMMARY OF THE INVENTION

An eddy current brake in accordance with the present invention generally includes a diamagnetic or non-magnetic member, a first support wall and a separate second support wall disposed in a spaced apart relationship with the first support wall for enabling the member to pass therebetween.

A first linear array of permanent magnets is disposed on the first wall on the side facing the second wall and a second linear array of permanent magnets is disposed on the second wall on the side facing the first wall. The first and second arrays are parallel with one another and spaced apart from one another for allowing passage of the member therebetween and causing eddy current to be induced in the member which results in the braking force between the magnets and the member. No magnetic connection, such as a yoke, is required between the walls or the arrays of permanent magnets. This feature enables adjustability of the distance between the member and the magnet arrays.

In accordance with the present invention, apparatus is provided for moving a least one of the first and second walls in order to control eddy current induced in the member during the passage of the member therepast in order to adjust braking force between the magnets and the member. In one embodiment of the present invention, the apparatus includes means for moving at least one of the first and second walls in a direction perpendicular to the member, and in another embodiment of the present invention, the apparatus includes means for moving at least one of the first and second walls in a direction parallel to the member.

Thus, it can be seen that the apparatus in accordance with the present: invention provides for changing the spaced apart relationship between the first and second walls in order to control eddy current induced in the member during passage and adjust a braking force between the magnets and member.

Accordingly, the amount of deceleration provided to a given car may be adjusted in accordance with the present invention. In addition, cars of various sizes and weights may be utilized and the eddy current magnetic brake in accordance with the present invention adjusted to provide the proper, or desired, deceleration. In one embodiment to the present invention, apparatus is provided for adjusting the eddy current induced in the member, and the braking force, as a function of velocity of the member between the arrays. Thus, cars having various velocities upon passing the brake, can be decelerated to a more uniform velocity exiting the brake in accordance with the present invention.

In this embodiment of the brake, the apparatus for adjusting eddy current includes a linkage mounting at least one of the first and second walls to a fixed foundation for enabling movement of the member therepast to change a distance between at least one of the first and second walls and the member. More particularly, the linkage may provide for changing a spaced apart relationship between the first and second walls.

An embodiment of the present invention includes linkage for enabling movement of the member to change a transverse relationship between at least one of the first and second walls of the member and another embodiment provides linkage for enabling movement of the member to change a parallel relationship between the first and second walls and the member.

Magnetic coupling and inducement of eddy current is effective through a linear array of permanent magnets which includes a channel and plurality of magnets disposed therein. The magnets may be arranged within the channel in two adjacent rows with each magnet in each row being arranged with a magnetic field at a 90° angle to adjacent magnets in each row along the channel. Each magnet in each row is also arranged with a magnetic field at an angle to another adjacent magnet in the adjacent row.

BRIEF DESCRIPTION OF THE DRAWINGS

The advantages and features of the present invention will be better understood by the following description when considered in conjunction with the accompanying drawings in which:

FIG. **1** is a perspective view of an eddy current brake in accordance with the present invention generally showing first and second spaced apart support walls and first and second linear arrays of permanent magnets along with a diamagnetic or nonmagnetic member attached to moving apparatus such as a car, represented by dashed line;

FIG. **2** is a perspective view of a first linear array of permanent magnets disposed upon a first support walk;

FIG. **3** is an elevational view of the brake shown in FIG. **1**;

FIG. **4** shows a selectively actuatable brake system disengaged;

FIG. **5** shows a system of FIG. **8** engaged;

FIG. **6** is an elevational view of an alternative embodiment according with the present invention further showing apparatus for moving at least one of the first and second walls in order to control the distance between permanent magnets and opposing walls for adjusting braking force between the magnets and a member;

FIG. **7** is plan view of the brake shown in FIG. **6**;

FIG. **8** is an enlarged view of a linear array of permanent magnets in accordance with the present invention generally including a channel and a plurality of magnets disposed therein in a particular arrangement as will be hereinafter described in greater detail;

FIGS. **9** and **10** show embodiment of the present invention similar to that shown in FIGS. **8** and **9** and further including apparatus for adjusting eddy current induced and the member, and braking force, is a function of velocity of the member between arrays of magnets;

FIGS. **11–14** are diagrams of alternative embodiments of the present invention which provide for linkage from at least one of the first and second walls to a fixed foundation for enabling movement of the member past the first and second walls with the first and second magnet arrays thereon to change a perpendicular relationship between the first and second walls and the member.

DETAILED DESCRIPTION

For the ensuing description of a braking apparatus **10** for an object **12**, reference is made particularly to FIGS. **1–3**. The object **12** is shown in generalized form only and is contemplated for movement in the direction of the arrow. Affixed to the object **12** is a member, or fin, **14** which extends outwardly from the object **12** and also moves with the object in the direction of arrow **15**.

At some point along the path of movement there are mounted first and second laterally spaced magnet arrays **16** and **18**. Each array includes an elongated support wall **20** which may be any cross-section, such as, for example an L-shaped cross-section, and on a lateral surface thereof, there are provided a linear series of permanent magnets **22**, of any size, arrangement or configuration. For instance, the magnets may alternate in polarity as indicated by the identification letters "S" and "N". Also, the space **26** between the arrays is dimensioned and arranged with respect to the object path of movement, that the fin **14** will move along the space directly opposite the magnets and spacers, but remain out of physical contact with either the magnets or spacers.

When the fin **14** passes through the magnetic field existing in the space **26**, an electric current (eddy current) is induced in the fin **14** which, in this case, reverses as the fin passes from a magnet of one polarity to a magnet of opposite polarity. These eddy currents produce a force exerted on the fin **14** (and object **12**) of such direction as to reduce the velocity of movement of object **12** and fin **14**. It is this deceleration that produces the "braking" of the present invention.

Although the above-described first embodiment includes movement of the object and fin past fixedly located magnet arrays, the magnet arrays can just as well be moved past a stationary object and fin. All that is needed to achieve the braking effect is relative movement between the magnets and fin. Since usually the object is moving, in that case the magnet arrays would be carried by the object and the fin fixedly mounted adjacent the path of movement. The choice of which technique to employ depends upon the particular application.

In its more general aspects, the invention can be advantageously employed for braking a large variety of moving objects. As an excellent example, eddy current braking for elevators could be highly advantageous as an emergency measure where normal operation has somehow been interfered with or disrupted. Also, many amusement park rides could benefit by having eddy current braking devices to retard excessive speed as the "ride" vehicle takes a corner or drops at a severe angle.

FIGS. **4** and **5** illustrate an object **52** with a brake fin **54** interconnected therewith, that moves generally along a direction indicated by an arrow **56** which normally will pass by a magnet carrier **58** beyond the range of substantial magnetic interaction (FIG. **4**). The object **52** and fin **54** are provided with means **60** selectively actuatable for moving them toward the magnet carrier so as to effect magnetically coupling therewith (FIG. **5**) and achieve braking.

With reference to FIGS. **6** and **7**, there is shown an alternate embodiment **100** of the eddy current brake in accordance with the present invention generally including a diamagnetic or non-magnetic member **102**, a first support wall **104** and a second support wall **106**. Walls **104**, **106** are separate from one another and disposed in a spaced apart relationship upon a base or foundation **110** via leg portions **112**, **114** respectively. The spaced apart relationship enables the member **102** to pass between the walls **104**, **106** and because **104**, **106** are not fixed with respect to one another, a distance D therebetween can be adjusted as will be hereinafter discussed in greater detail.

A first linear array **120** of permanent magnets **122**, see FIG. **8**, is disposed on the first on a side **124** facing the second wall **106**.

A second linear array **130** of permanents (not individually shown) are disposed on the second wall **106** on a side **132** facing the first wall **104** with the first and second arrays **120**, **130** being parallel with one another as shown in FIG. **10**. Apparatus **140**, **142** is provided for moving the walls **104**, **106** and change the spaced apart relationship between the first and second walls **104**, **106** in order to control, or adjust, eddy current induced in the member **102** during passage of the member **102** past and between the walls **104**, **106** and magnets **120**, **130** thereby adjusting the braking force between the magnets arrays **120**, **130** and the member **102**.

The apparatus **140**, **142** may include adjusting nuts **144**, **146** and bolts **148**A, **148**B, **150**A, **150**B interconnected between the walls **104**, **106** and brackets **152**, **154** fixed to the base **110**.

Jam nuts **156**, **158** prevent unwanted movement of the adjusting nuts **144**, **146** and securing bolts **160**, **162** extending through the base **110** and legs **112**, **114** through slots **166**, **168**, fix the walls **104**, **106** in a desired spaced apart relationship after adjustment. The exact size of the walls **104**, **106**, magnet arrays **120**, **130**, member **102** and spacing D will be dependant upon velocity and weight of a car (not shown) attached to the member **102** and may be empirically determined.

It should be appreciated that the apparatus **140**, **142** may include any number of configurations for adjustment of the walls **104**, **106**. Such alternatives including single direction bolts, worm screws, jack screws, short in-line turn buckles, or other electrical, pneumatic, hydraulic system capable of providing the adjustment of spacing D, between the walls **104**, **106**. Such configurations may eliminate a need for the securing bolts **160** and **162**.

Preferably, each magnet array **120**, **130**, as illustrated by the array **120** in FIG. **12**, includes at least **1** row **170**, each having individual magnets **180**, **182**, **184**, **186**. A second row **172** may include individual magnets **188**, **190**, **192**, **194** respectively.

The magnet rows **170**, **172** may be disposed in a tube, or channel **200** which may be formed of any suitable material such as aluminum, stainless steel, plastic; any number of magnets (not all shown) may be used.

The magnets **180**, **194** are specifically arranged within the channel **200** with a specific magnetic field pattern. While two rows **170**, **172** are shown, it should be appreciated that any suitable number of rows (not shown) may be utilized.

The channel **200** may be removably attached in any suitable manner to the wall **104**. Thus, as hereinabove noted, assembly of the brake **100** is facilitated. Another advantage of the preassembly of magnets **180–186** is the is the fact that alternative magnet configurations may be easily exchanged on the wall **104** in order to tailor magnetic braking characteristics.

More particularly, a magnet **182** in a row **170** is arranged with a magnetic field (indicated by the arrow **204**) which is at an angle to the magnetic fields **206**, **208** of adjacent magnets **180**, **184** in the row **170**. A number of angular relationship between the adjacent magnets **180**, **182**, **184** such as, for example, 15°, 30°, 45° or 90°. When the angular relationship between adjacent magnet **180**, **182**, **184** is 90°, they may also be arranged with the magnetic field **104** at a 90° angle to a magnetic field **210** of the magnet **190** in the adjacent row **172**.

Preferably, the magnets **180–194** are epoxied into the channel **200** and thereafter attached to the wall **104** in any suitable manner. Also, the channel **200** may be open, as shown, or closed, (not shown) and be of any suitable shape for containing the magnets. Because the magnets may be assembled in the channel **200** before installation on the wall **104**, **106**, assembly of the brake **100** is facilitated. In addition, change of magnetic field can be easily performed by changing of channels (not shown) having different magnet configurations therein.

The multi-row Halbach arrangement as shown in FIG. **8**, can be built with no backiron. The advantage is that most of the flux is confined to the member of fin **102** area, without needing backiron as is needed in the standard eddy current brake (not shown). The flux is concentrated between the magnet array and is small above and below the magnets. Significant weight improvements result because no backiron is used.

Multiple rows **170**, **172** in proper alignment permit the use of the cubic Halbach arrangement in such a way that brakes of increasing power levels can be constructed while maintaining a fixed depth of magnet.

The Halbach array can achieve higher braking forces for the equivalent volume of magnetic material of a conventional ECB. The Halbach array reduces stray magnetic field through the inactive side of the array.

With reference to the diagrams shown in FIGS. **13** and **14**, apparatus **250** including links **252**, **254** interconnecting the wall **104** with a foundation **258** provides for changing, controlling, or adjusting eddy current induced in the member **102**, and braking force, as a function of member **102** velocity between the walls **104**, **106** and arrays **120**, **130**. Only one wall **104** is shown in FIGS. **13**, **14** for the sake of clarity.

As shown by the directional arrows **260**, **262** in FIGS. **13**, **14** respectively, movement of the member **102** past the wall **104** and array **120** attached thereto provides a reaction force as shown by the arrow **266** which raises the wall **104** from stops **270**, **272** in order to change a transverse relationship between the wall **4** and array **120** and the member **104**. This transverse movement raises **104** increasing relative penetration of **102**, which increases the induced eddy currents and braking action.

Because the drag force is a function of velocity, when the walls **104** are mounted for pivoting on the links **252**, **254**, the wall **104** is raised a specific height based upon the drag force generated causing rotation of the links **250**, **254**. Thus, the penetration of the member **102** into the magnetic flux established by the arrays **120**, **130** is self regulated.

When used in one orientation, as shown in FIGS. **9**, **10**, the member **102** having a velocity in excess in a predetermined value would generate drag forces **266** sufficient to rotate, or pivot, the wall **104** to increase member **102** penetration and subsequently generating higher drag forces to reduce the excess velocity. As the velocity falls below the level necessary to generate drag force sufficient to fully rotate the wall **104** and pivot linkages **252**, **254**, the wall **104** rotates back toward the default position. How far back it rotates is a self regulating function of the velocity/drag force in that instance.

Thus, the apparatus **250** can be utilized as an automatic "trim" brake actuating only when necessary and only with a force necessary to maintain the desired velocity of the member **102** and vehicle attached (not shown). Opposite linkages (not shown) would have the effect of lowering the wall **102** upon movement of the member **102** therepast, thereby having the effect of flattening the initial drag peak and providing flatter more uniform deceleration.

As diagramed in FIGS. **11** and **12**, apparatus **280** including pivoting links **282**, **284**, **286**, **288** interconnected between a foundation **290** and the walls **104**, **106** enable movement of the member as indicated by the arrow **302** to pivot the links **282**, **284**, **286**, **288** in direction indicated by the arrows **304**, **306** in order to, change a distance d_1 between the walls **104**, **106**. The magnet arrays are not shown in FIGS. **11** and **12** for the sake of clarity in describing wall **104**, **106** movement. Since the walls **104**, **106** carry the magnet arrays **120**, **130** the distance between the arrays **120**, **130** is also varied. The links **282**, **284**, **286**, **288** may include spring loaded pivots **310**, **312**, **314**, **316** respectively in order to bias the walls **104**, **106** against stops **320**, **322** in a rest position.

As shown in FIG. **12**, movement of the member between the walls **104**, **106** decreases the distance d_1 to d_2, thus increasing the induced eddy currents and increasing a braking action. A stop **326** defines the minimum distance d_2 of approach between the walls **104**, **106**.

Similar linkage apparatus is shown in FIGS. **13** and **14** in connection with the walls **104**, **106** and member **102**. In this instance, links **342**, **344**, **346**, **348** are interconnected so that movement indicated by the arrow **360** of the member **102** causes a spread or widening as indicated by the arrows **364**, **366** of the walls **104**, **106**. Stops **370**, **372**, **376** limit the movement of the walls **104**, **106** in a manner similar to that described in connection with the apparatus **280** shown in FIGS. **11**, **12**.

Spring loaded pivots keep the walls **104**, **106** initially biased against the stop **376**. This configuration lowers the magnetic coupling due to movement of the member **102** between the walls **104**, **106** and, as hereinabove noted, has the effect of flattening the initial drag peak and provide a flatter more uniform deceleration. It should be appreciated that other means of opening and closing arrays and lowering the walls **104**, **106** may be utilized which can include other mechanical, pneumatic, hydraulic or other components (not shown) to provide the same function.

Although there has been hereinabove described an eddy current braking apparatus in accordance with the present invention for the purpose of illustrating the manner in which the invention may be used to advantage, it will be appreciated that invention is not limited thereto. Accordingly, all modifications, variations or equivalent arrangements which may occur to those skilled in the art should be considered to be within the scope of the invention as defined in the appended claims.

What is claimed is:

1. An eddy current brake comprising:

a diamagnetic or non-magnetic member;

a first support wall;

a separate second support wall disposed in a spaced apart relationship with said first support wall for enabling the member to pass therebetween;

a first linear array of permanent magnets disposed on the first wall on a side of the first wall facing the second wall;

a second linear array of permanent magnets disposed on the second wall on a side of the second wall facing the first wall, the first and second arrays being parallel with one another; and

apparatus for adjusting eddy current induced in the member, and braking force, as a function of velocity of the member between the arrays, said apparatus including linkages for enabling movement of the member therepast to change the spaced apart relationship between the first and second walls.

2. Eddy current braking apparatus comprising:

a diamagnetic or non-magnetic member;

a linear array of permanent magnets including a channel and a plurality of magnets disposed therein, the magnets being arranged within said channel in two adjacent rows, each magnet in each row being arranged with a magnetic field at a 90° angle to another adjacent magnets in each row along the channel, each magnet in each row also being arranged with a magnetic field at an angle to another adjacent magnet in the adjacent row; and;

means, mounting the linear array with respect to the member, for enabling passage past one another at a distance sufficient to cause eddy currents to be induced in the member resulting in a braking force between the linear array and the member.

3. The brake according to claim **2** further comprising a second linear array of permanent magnets including a second channel and a plurality of magnets disposed therein, the magnets being arranged within said second channel in two adjacent rows, each magnet in each row being arranged with a magnetic field at a 90° angle to adjacent magnets in each row along said second channel, each magnet in each row also being arranged with a magnetic field at a 90° angle to another adjacent magnet in the adjacent row; and

means, mounting the second linear array with respect to the member, for enabling passage past one another at a distance sufficient to cause eddy currents to be induced in the member resulting in a braking force between the linear array and the member.

4. The brake according to claim **3** further comprising a first support wall for, supporting the linear array, and second wall for supporting the second linear array and apparatus for moving at least one of the first and second walls in order to control the eddy current induced in the member during passage of the member therepast to adjust braking force between the magnets and the member.

5. The brake according to claim **4** wherein the apparatus includes means for moving at least one of the first and second walls in a direction perpendicular to the member.

6. The brake according to claim **4** wherein the apparatus includes means for moving at least one of the first and second walls in a direction parallel to the member.

7. The brake according to claim **3** further comprising a first support wall for supporting the linear array, a second wall, disposed in a spaced apart relationship with said first support wall, for supporting the second linear array and apparatus for changing the spaced apart relationship between the first and second walls in order to adjust eddy current induced in the member, and braking force, as a function of velocity of the member between the arrays.

8. The brake according to claim **7** wherein the apparatus for adjusting eddy current includes a linkage mounting at least one of the first and second walls to a fixed foundation, for enabling movement of the member therepast to change a distance between at least one of the first and second walls and the member.

9. The brake according to claim **7** wherein the apparatus for adjusting eddy current includes linkages, mounting the first and second walls to a fixed foundation, for enabling movement of the member therepast to change the spaced apart relationship between the first and second walls.

10. An eddy current brake comprising:

a diamagnetic or non-magnetic member;

a first linear array of permanent magnets;

a second linear array of permanent magnets disposed in a spaced apart relationship with said first linear array for enabling the member to pass therebetween, the first and second arrays being parallel with one another; and

apparatus for adjusting eddy current induced in the member, and braking force, as a function of velocity of the member between the arrays, said apparatus including linkages for enabling movement of the member therepast to change the spaced apart relationship between the first and second arrays.

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